ROADS AND STREETS

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What Next in Highway Evolution?

In its recent evolution highway transportation has paralleled rail transportation in many respects. Thirty years ago who foresaw automatic "stop and go" signals controlling traffic on city streets? Yet with the advent of motor cars moving at railway speed, it might easily have been predicted that some such system of signalling would become necessary. Easily predicted—but no one predicted it.

Even yet we hesitate to draw a close parallel between rail and highway development. For example, not many of us regard as serious the prediction that main motor highways will eventually be built so as to have few "grade crossings." Yet the great saving of time that will be effected in congested regions by such highways makes it certain that they will eventually be built in and near every large city.

As to building streets that do not intersect at grade, the problem is admittedly a difficult one because of the expense involved. But when the cost of such highways is borne by the state or the city at large, instead of by abutting property owners, there will be rapid development of the two-level street.

Fortunately an elevated motor street is not as objectionable as an elevated railway in a city, because motor cars are comparatively noiseless. This advantage may lead to the building of certain motor roads down the center of a tier of blocks, and right through buildings. If this were done, many stretches of motor highways would virtually be tunnels through buildings. Relatively little property would thus be destroyed, and it seems likely that the greater flow of traffic thus secured would increase real estate values considerably.

In some cities there are water channels that may be utilized for highway purposes. The Arroyo Seco in Pasadena and Los Angeles is a wide channel that is to be converted into a highway and park for some ten miles or more. A dam has been built that prevents floods from coursing down the arroyo, and there is consequently available an admirable location for a broad highway that crosses beneath other roads and streets.

This suggests that in some instances it may pay to build new channels that will carry creeks or even rivers around cities, leaving the old channels available for highway purposes.

Nearly 50 years ago the first rotary snow plow made its initial trip through Rocky Mountain snow drifts that were impenetrable to other plows. Who that saw that plow or its successors dreamed that one day similar rotary plows would be used on country roads? Only within the last decade has the removal of snow from roads become at all common. And even yet, we have only made a good beginning, for but a very small fraction of our country roads is kept clear of snow. Here again the railway might have led us to foresee an important development in the highway field.

Where rail traffic has become very dense, two tracks are devoted to freight and two to passenger trains. This separation of slow from fast moving traffic seems likely to become common on country roads near cities, and possibly in city streets. We doubt whether any of us yet fully realizes the amount of express and freight that is destined to travel over our highways. With the advent of the fast moving truck mounted on pneumatic tires, this sort of traffic is likely to increase very rapidly. Whether motor trucks will be economically operated at as high speeds as motor cars is questionable. If not, nothing seems more certain than that many special highways will be constructed for motor trucking.

We have mentioned four ways in which highway evolution has already paralleled, or has begun to parallel, railway evolution. We will close with an example or two of parallel development in the design of rolling stock. Quite recently "sleeping cars" have been put into operation on certain highway bus lines, the designs being similar to railway pullmans. A new type of motor bus that is strikingly like an electric street car is now in operation. Its gasoline motors are located beneath the car and on each side near the middle. The operation of several such cars in a train seems an unlikely development, yet it would be rash to say that anything now common in railway transportation may not soon be equally common in highway transportation, even to the "last call for dinnah in the dinin' cah."

"Engineering Schools Should Teach Economics"

Under the title "Engineering Schools Should Teach Economics" a recent editorial article in an engineering magazine criticized some alleged errors of an engineer and placed the blame for his alleged mistakes upon his apparent lack of training in economics. We agree with the editorial opinion that engineering colleges should teach economics; but we think that the editor in question himself exemplifies the very lack of economic training that he deplores.

The first criticism of the engineer by this editor was that he used 7 per cent instead of using about 5 per cent in computing interest charges on a municipal pumping plant. This criticism was probably correct if the municipality could borrow money at 5 per cent without straining its credit. Not infrequently engineers of railways, on the other hand, make the mistake of using a bond interest rate of about 5 per cent instead of using a "fair return rate" of about 7 per cent.

The second criticism was that the engineer had used a 7 per cent annual depreciation rate; and this editorial statement was made: "Now, if a depreciation charge is set up, the invested capital decreases each year by this amount. Consequently, the interest should either be calculated on the basis of a diminishing capital or a diminishing depreciation."

Neither the premise nor the conclusion is correct. If a depreciation charge is set up and if a sinking fund is established to retire the plant at the end of its life, both the capital investment and the depreciation rate should be regarded as constant. This is the ideally correct treatment of depreciation where no change in price levels occurs. An approximately correct method consists in using a depreciation rate determined by dividing 100 by the estimated life in years, and in that case an approximately correct result is obtained when the invested capital is reduced each year by the amount of the annual depreciation found by multiplying the "straight-line" rate by the original cost (not the depreciated value) of the plant. On short lived property this approximate "straight-line" method is often satisfactory enough, but on a long lived plant it leads to very incorrect results, for it is tacitly based on the assumption that the depreciation annuity can earn no interest, which is clearly erroneous.

The third criticism of this engineer is even more clearly wrong than the second criticism, yet it exemplifies one of the commonest of economic blunders. Says the editor: "To make the situation still more illogical, when comparing the cost of operation of the present plant and purchased energy, this engineer ignored the fixed charges on the present plant when estimating the cost with purchased power, even though the investment still exists in the shut down plant."

Here we see that the critical editor regards the original cost of an obsolescent plant as being an element that must be considered in ascertaining whether it is cheaper to retire it or buy electric current from a central station. As a matter of fact it is wholly immaterial what the original plant did cost. The problem differs radically from one in which two alternative new and rebuilt plants are being compared economically, or from a problem in which the cost of generating power with a proposed new plant is being contrasted with the price at which such power can be purchased. In the case of an old plant that is obsolescent, the problem is really whether its obsolescence has progressed so far that its true economic value is less than its scrap value, or not. If not, it should continue to be operated, even though its true depreciated value be but little more than its scrap value.

Stated differently, the problem then is to ascertain whether the operating expense (exclusive of interest charges) per unit of power generated by the old plant is greater or less than the price per unit of purchasable power.

The problems of depreciation and the allied problem of when to retire an old plant or plant-unit, have been discussed in the "Handbook of Mechanical and Electrical Cost Data" by Gillette and Dana, to which the reader is referred for full proof of certain of the statements above given.

In the course of a rather extensive experience, the editor has found more ignorance among engineers on the problems above mentioned than on almost any other economic matter.

Because of ignorance of economic facts and principles hundreds of millions of dollars worth of plant have been retired too soon, and other hundreds of millions have been kept in service too long. To emphasize the seriousness of the whole matter, we have just quoted from a prominent engineering magazine a criticism of an engineer in which the editorial critic displayed his lack of understanding of certain principles involved.

It is apparently the opinion of the majority of teachers of engineering that there is no necessity of teaching economics as a special subject, and that all the principles of engineering economics can be learned incidentally as a sort of by-product of one or more of the engineering studies. It should not be difficult to test this opinion by submitting the fourth year students to a thorough examination in economics. It may be that the editor has been peculiarly unfortunate in having employed so many graduate engineers who could not pass such examinations.

Ask a number of such questions as this: How would you determine what rate of interest to use in capitalizing annual expenses? The answers that the editor has received have almost invariably shown no appreciation that it is a real problem itself to determine the correct percentage. Throughout Wellington's "Economic Theory of Railway Location" a bond interest rate is erroneously used to capitalize annual expenses and to estimate that part of fixed charges that relates to interest. In the original appraisal of the franchise value of the railways of Michigan and Wisconsin, a bond interest rate was erroneously used in capitalizing net earnings.

There seems to be prevalent the idea that if correct principles are applied it is a matter of minor concern whether the alleged facts are correct. Last year's net earnings, for example, are often assumed to be typical, without a thorough study to show what is a typical year's net. Depreciation rates are guessed at, although usually they may be ascertained with considerable accuracy from past accounting records that are properly interpreted. Here again very few engineers that the editor has encountered in rate cases know how to derive a depreciation rate from past accounting records; most of them asserting it to be impossible because in the earlier years no distinction at all was made between maintenance expenditures and retirement (depreciation) expenditures. The problem can be readily solved none the less.

Like any other subject that attains the rank of a separate branch of science, economics should be studied by itself. Unfortunately that particular branch of economics known as political economy has come to be regarded by many as being the only economics. For the most part it still remains a mass of unproved hypotheses and hot air. Business and engineering economics, on the other hand, have largely emerged from the stage of unproved hypotheses. Still the data that must be inserted in the formulas are often woefully unsatisfactory. The lives of many kinds of machinery and structures are usually guessed at. Interest rates are guessed at. Even unit cost prices are often guessed at. Overhead percentages are often guessed at. All this, too, by many engineers who would be shocked at hearing themselves called economic ignoramuses.

If this state of affairs is not traceable to the by-product treatment that economics has received in many engineering colleges, then what is the cause of it?

H. P. Gillette

"Why States Should Build Pavements Through Towns"

The Situation in Iowa

To the Editor: I have read with much interest your editorial entitled "Why States Should Build Pavements Through Towns."

I am glad you are taking hold of this matter and hope that something will come of it. However, many of the articles written along this line as well as this one itself display a certain petulance against the cities and towns and various allusions to their supposed shortcomings.

I must admit that in writing these articles you are confronted with the fact that "Roads and Streets" circulates in numerous states and that the conditions governing financing of roads and streets undoubtedly may vary greatly.

I wish, if you will permit me, to refer to some misapprehensions as applied to the state of Iowa, which state is not far away from your home office.

In Iowa the country paving is built 18 ft. wide in general. Now there may be occasional paved city streets here narrower than this, but I do not recall ever seeing any. There are, however, numerous places where the 18-ft. country slab is flared out to 30 or 40 ft. to connect to existing city paving. The "bottle neck" therefore is encountered going out of town, not coming in.

The condition of the streets in cities and towns you have described accurately.

I note that you rap the city officials and voters of the towns because the city does not pass ordinances authorizing a different manner of financing streets and you further refer to "the magnitude of their inertia." The city officials are totally without authority to do anything of the kind as all such matters are regulated by state law.

In this state the city owner pays 100 per cent of the cost of his street improvements and contributes over half of the gas tax and automobile license money which is expended outside the cities and towns. He also pays a county road tax.

The League of Municipalities of this state has lobbied and numerous engineering communities have worked to get some equitable percentage of this money to improve city streets without avail. It is useless to assail city and town councils for not exercising an authority, which they do not possess.

Any engineer in municipal practice can recall innumerable cases where paving assessments placed on a few lots of doubtful value were far in excess of the cost of building paving by an 80-acre farm, yet all such assessments are being refunded in this state.

Many members of the legislature seem to find it better and safer politics to neglect the cities and towns, but have them pay the bills. They talk farm relief but not city relief.

The legal procedure in Iowa for instance, preliminary to paving a street under the provisions of the state law requires seven to nine weeks before a contract may be let. As the fiscal year begins April 1st a new council even if it might be assumed that they required no time whatever to become familiar with the conditions and the necessities of their town can scarcely let a contract before June or July. In consequence the advantage of early lettings is lost and the contractor finishes up his work in frost and snow.

In Iowa the great advantage of letting to the best and most reliable bidder is denied the cities and they must let to the lowest bidder or reject all bids. Any engineer knows the desirability of having the prospective bidder answer a complete questionnaire covering his financial ability, experience, equipment, etc., as is customarily done by state highway commissions.

The general public and the state legislatures seem to be ignorant of or indifferent to the fact that the immense situation caused by the overwhelming influx of motor driven vehicles, whereby it seems necessary to improve thousands of miles of roads faster than it can really be done, has hit the municipalities just as hard as it has hit the country roads.

Heroic efforts are being made to get the country roads up out of the mud, while in the cities and towns we are still in the ox team days so far as any legislation calculated to speed up the construction of modern paved streets is concerned. The public seems pretty well awakened as to the necessity of immediate construction of country roads. When they ride over a shabby, bumpy, ill kept city street their first instinct is to roast the city fathers and all the inhabitants of the city in question, including their ancestors and their descendants.

It is true that certain portions of streets of cities of just the right number of population and with the houses exactly the right distance apart may be paved with an 18 ft. strip, not a finished city pavement.

My own view is that the state should construct or turn over to the city the equivalent cost of construction of a bona fide city street of width adequate for the particular thoroughfare in question with suitable curb and gutters, drainage, water inlets, etc., exactly as the city would do if building the street. They should discontinue the practice of building country roads through the corporate limits of towns, on built up grades higher than the sidewalks and without eliminating side ditches and borrow pits. City thoroughfares should be constructed with connections to intersecting streets and alleys taken care of with suitable paving and curb returns. Existing streets should be matched up to in grade or some adequate disposition of such matters made. In other words, in the country we want good country roads; in the cities and towns we want good city streets. The idea of building an 18 ft. strip through the city street and having the city patch this out into a city street at their own expense has undesirable features. In the first place the original design for the paving should contemplate a finished job. In the smaller cities particularly, those in authority may not realize what they are going to get until too late and to widen afterwards may result in an unworkmanlike job which becomes a permanent blemish. Center crowns may be wrong and paving returns into intersecting streets may have to be patched on with narrow strips and feather edges. In other instances paving grades as extended into these towns do not contemplate sufficient excess material to build more than a narrow berm along the concrete slab. This leaves the city in an embarassing position when it is desired to bring the entire width of the street to grade and build or raise sidewalks.

An original design for a complete finished street would cover all such matters including the handling of drainage. The city would also have sufficient notice so they could grind through with the complicated legal procedure now required.

The towns in this state according to figures frequently put out are already paying in more than half of the road money. They should be permitted to discontinue forcing upon a reluctant public heavy paving and curbing assessments, which fall alike on the millionaire the widow and washwoman, the aged and infirm.

I am not trying to assume an unreasonable criticism of your article. I consider "Roads and Streets" one of the most valuable technical periodicals I take. You have the courage of your convictions and I would be glad to see you go farther into this matter of city streets. If any one can wake up the somnolent public it ought to be you.

There are other angles to the Iowa law governing the financing of streets which would bear your investigation.

J. H. HOWE,
City Engineer,
Cresco, Ia.

Twenty-Mile Slag Tarmacadam Road in Australia

By E. F. STEVENS
Engineer B. H. P. ByProducts Pty., Ltd., Newcastle, N. S. W.

The use of slag in Australia was limited to only a few short lengths of road until about 3 years ago, when the Main Roads Board of New South Wales came into existence. This body has, in conjunction with the local (Newcastle) authorities, reconstructed quite a number of our main roads, the most important of which, in this district, is that from Newcastle to Maitland.

The Newcastle-Maitland Road is constructed of slag throughout its 20 miles of length, mostly by the penetration method, one length only (5 miles long) being to a pre-mixed specification. The specification provided for 3-course work, i. e., two base courses each consolidated to 4 in. thickness, and a penetration course, giving a total depth of 11½ in.

Where this has been placed on a reasonable foundation, the results have been excellent, the only weak places being found on lengths traversing virgin ground on several deviations. The good results obtained in this particular work have been responsible for a wider use of the material, which has always been in the past regarded with a good deal of suspicion. Then again, until the advent of the Main Roads Board there was not a big demand for road materials.

We get very successful results from slag fines,—our ⅜-in. material—when used for binding in surface treatment of roads.

While, of course, the quantities used here would appear small to Americans, the road I refer to has about 4,000 tons of slag to the mile for 15 miles, and several other shorter jobs pro rata, so that in a year or two we will probably be able to give some further useful information regarding the wearing qualities, etc.

Views of the Newcastle-Maitland Highway in New South Wales, Australia—a 20-Mile Slag Tar Macadam Road

Southwest Road Show and School

The 4th annual Southwest Road Show and School, which will be held at the Exposition Building, Wichita, Kan., Feb. 26 to March 1, 1929, inclusive, is calling particular attention to the educational features during the four days of the show. Not only are the exhibits at the booths and the improved road machinery of interest to those who are fortunate enough to attend this educational exposition, but the discussions on road construction and maintenance at the road school, by the foremost construction engineers in the United States, are highly interesting even to the layman.

The United States Bureau of Public Roads; the American Association of State Highway Officials; the Republic of Mexico; Oklahoma; Kansas, Nebraska; Colorado; Texas; Missouri; South Dakota; and Kansas State Agricultural College had exhibits at the school last year and will have again this year, augmented by exhibits from other states in road show territory.

The show, as heretofore, will be held under the auspices of the Wichita Thresher and Tractor Club, of which F. C. Wieland is general manager.

State Forces Build Michigan Highways

Cost Keeping Forms and System Explained in Detail

By M. O. HAMMER
Cost Data Engineer, Michigan State Highway Department

CONSTRUCTION of state highway work by day labor on a large scale is a project being developed by the Michigan State Highway Department. They have thirty-two live jobs in operation at the present time and have established a system of keeping a record of costs. In this article, Mr. M. O. Hammer, Cost Data Engineer for the department, discusses the forms they have set up for recording transactions and which they use as a control on the job.

This is the first of a series of articles giving cost data on Michigan's state highway day labor work. Mr. Hammer has decided to start the series with an explanation of the forms used so a better understanding of their problems may be had.—The Editor.

Daily Unit Cost Sheet.—The purpose in all these forms is to collect together costs of different operations of work and send them in each night to our central office where they are looked over and prepared for our daily unit cost sheet, a copy of which is made up and shown in the accompanying illustrations. This cost sheet is not a true sheet of any particular job, but merely a sample made up in our usual form to show you how we obtain our various costs.

In our costs on underdrainage and culvert work, we have not gone into any detailed form—that is, we have not tried to keep costs on the different sizes of tiles and the different details of catchbasins, small culverts, etc. We merely keep our costs separated into labor, materials, equipment rental, supplies, handling and hauling costs, overhead, etc. The only way we have of telling whether or not we are above board or below is by comparing the total amount of money spent on culverts against the total amount of money credit shown on the engineer's estimate every first and fifteenth of the month. We do, however, occasionally pick out some large box culvert and keep individual costs on it.

The next item on this daily unit cost

FOREMAN'S DAILY TIME SHEET

USE THIS SIDE OF SHEET FOR LABOR ITEMS ONLY.

Occupation	Name		Hours	Rate	Office Use Amount
~~Foreman~~	~~F. Kelley~~	~~(1)~~	~~10~~	~~.75~~	~~7.50~~
Operator	H. Stevens	(1)	10	.80	8.00
Operator	J. Scott	(1)	11	.45	4.95
Finisher	F. Cramer	(1)	11	.60	6.60
Finisher	W. Creech	(1)	11	.60	6.60
Forms	C. Jones	(3)	10	.50	5.00
Forms	L. Smith	(3)	10	.50	5.00
Forms	H. Smith	(3)	10	.50	5.00
Laborer	J. Williams	(1)	10	.40	4.00
Laborer	C. Hauser	(3)	10	.40	4.00
Laborer	H. Koib	(2)	10	.40	4.00
Laborer	W. Lewis	(4)	10	.40	4.00
Laborer	R. Jackson	(4)	10	.40	4.00
Team & Mer	W. Holt	(3)	10	.75	7.50
No. of Inmates Used 10		Total Hrs.	100	.30	30.00

General information as to time allowance of crew .....

Cause of Delay .....

Correct ..... Frank Kelley ..... Foreman.

MICHIGAN STATE HIGHWAY DEPARTMENT
STATE CONSTRUCTION DIVISION

FOREMAN'S DAILY REPORT

(Turn in to Time Keeper Daily)

Work Done. Sta. 519 + 20 to Sta. 525 + 20

Nature of work and amount 1222.1 s.y. (550')
7" C. 9" E. Std. Pavt. Poured, finished and covered

No.	Equipment Name		Hours	Office Use Rate	Office Use Amount
27	Rex Paver	(1)	10	3.85	38.50
14	Lakewood Finisher	(1)	11	1.25	13.75
	Float Bridge	(3)	10	.02	.20
	Water pipe (3 mi.)	(2)	10	42.77	128.30
	Forms (600 ft.)	(3)	10	.001	6.00
16	Sub-grades	(4)	10	.40	4.00
18	Tractor	(4)	8	.85	6.80

Supplies	Office Use Amount	Materials	Office Use Amount
32 gals. Gas	5.75		
3 " Oil	.60		
2 lbs. Grease	.50		
2 L.H. Shovels	2.80		
1 18" Stil.Wrench	2.85		

Classification 10 Job No. K-1 c-1 Date 8/3/27

Checked ..... W. Allen ..... Timekeeper

True Size—9½x8 in.

MICHIGAN STATE HIGHWAY DEPARTMENT

STATE CONSTRUCTION DIVISION—DAILY UNIT COST SHEET

Project C.S. No. 1034-3801 Date July 31, 1928

CLASSIFICATION	Daily Quantity Work Done	DAILY COST Labor	Equip.	Material	Supplies	DAILY UNIT COST	BUDGET ALLOWANCE Quantities	Unit Price	TOTAL TO DATE Quantity Work Done	COSTS Total	Unit	FOREMAN
2 Culverts												
A Labor		7.00			.74		Excavate for H.W.		Lay 2-15" R. C. P. Culv.s			Worth
B Handling & Hauling		3.00					More Mixer from 59-1801					Ort
		10.50	1.02		.99		Haul Water & Cement					Wraight
A Labor										143.50		
B Materials										381.78		
C Equipment Rental										7.23		
D Supplies										57.08		
E Handling & Hauling										36.22		
F Overhead										24.29		
G Winter Overhead										9.54		
										659.64		
3 Earth Excavation	200	66.41	9.80		1.82	3.90	Balancing					F. Weeks
A Moving Equipment									10774	72.10	.007	
B Labor									8855	2874.13	.325	
C Equipment Rental									"	169.74	.018	
D Dynamiting										-0-		
E Supplies									8855	154.60	.017	
F Overhead									"	120.94	.014	
G Winter Overhead									10774	49.86	.005	
							10774	.55	8855	3447.37	.387	
9 Clearing & Grubbing												
A Labor		21.50			5.80	(Blowing stumps)				36.87		
B Equipment Rental										-0-		
C Supplies										3.50		
D Overhead										1.57		
E Winter Overhead										.61		
										42.55		
Earth Work									8855	3447.37	.387	
Clearing & Grubbing									"	42.55	.005	
Total Earth Work To Date							10774	.55	"	3489.92	.392	
10 Standard Pavement												
A Moving Equipment									17681	301.76	.017	
B Trenching	605	23.50	10.80		2.16	.06			"	979.37	.055	B.Culver
C Water Lines	1222.1	4.00	29.26		3.90	.03			"	502.28	.028	O.Smith
D Forms	960	20.65	26.10		1.15	.05			"	623.18	.035	S.Kelley
E Truck Haul	1222.1	232.20				.19			"	3364.79	.19	F.Meyers
G Mix-Place-Finish	1222.1	46.00	52.50		4.85	.088			"	2809.44	.159	E.Smith
H Curing	1222.1	20.00				.016			"	698.83	.04	"
I Materials	1222.1			602.45		..539			"	9459.35	.539	
J Shoulders									"	2079.15	.118	F.Allen
L Yard Set Up									"	450.30	.025	
M Yard Operation	1222.1	54.00	19.60		8.40	..067			"	1634.25	.093	Burley
N Overhead									"	899.58	.051	
O Winter Overhead									"	353.39	.02	
							17681	1.51	"	24155.57	1.365	
11 Reinforced Pavement												
A Moving Equipment									1245.3	21.24	.017	
B Trenching									"	66.98	.053	
C Water Lines									"	35.37	.028	
D Forms									"	43.88	.035	
E Truck Haul									"	236.86	.19	
G Mix-Place-Finish									"	197.75	.159	
H Curing		(Finished)							"	49.18	..04	
I Materials									"	958.06	.769	
J Shoulders									"	146.32	.118	
L Yard Set Up									"	31.70	.025	
M Yard Operation									"	115.07	.093	
N Overhead									"	63.26	.051	
O Winter Overhead									"	24.78	.02	
							1245.3	1.84	"	1992.45	1.599	
15 Seeding												
A Labor										21.00		
B Materials										47.58		
E Overhead										2.66		
F Winter Overhead										1.05		
										72.29		
17 Extra												
#1 Remove Pipe										3.15		
Overhead										.12		
Winter Overhead										.04		
										3.31		
18 Current Overhead		6.83			2.50		Office Payroll			-0-		
Dept. Constr. Cost										30373.28		
Cement 5883.75 Bbls. @ 2.39										14062.16		
Total Constr. Cost to Date										44435.44		

MICHIGAN STATE HIGHWAY CONSTRUCTION DIVISION

DAILY EQUIPMENT BREAKDOWN REPORT

Date 5/15/27 Classification 10-G

Job No. M 034-17 C-1 Equipment Name and No. Mixer #42

Delays in Minutes	Nature of Breakdown and Repair Parts Used
1-15'	Skip cable broken (18' 5/8" Steel cable)

Operator F. Welch Foreman C. Smith

True Size—5⅞x4¼ in.

TRAFFIC DEPARTMENT

Terminal Yard Report of Operations at Brooklyn Side A. M. Date 3/14 1927

P. M. Weather G A. M. P P. M

CAR. Number.	Initial.	Kind.	Contents.	Arrived. Date	Hour	Constructively Placed. Date	Hour	Actually Placed. Date	Hour	Released. Date	Hour	Date Notice to Agent of Release.	SEALS AND REMARKS.
33794	N.R.Y	Gon	Gravel	3/12	7/A	3/12	8/A	3/13	8/A	3/14	5/P	3/14	
52073	M.C.	Box	Cement	"	"	"	"	"	"	"	"	"	800 Sax

John Doe
Checker.

This form to be used by Yard Checkers—must be made in triplicate by use of carbon paper; original to be placed in special envelop and forwarded to Traffic Manager, morning following date of report.

Check of yard or unloading tracks must be taken daily at 6 p. m. and must include all operations of the day. When operations are carried on during the night a check of the yard must be taken at 7 a. m. and 6 p. m. When obliged to cease operations on account of inclement weather, write freight agent full particulars on form provided, copy to accompany daily yard report to Traffic Manager.

Freight Agent must also be notified in writing on form provided of released equipment.

Yard Checkers will be held strictly responsible for the accuracy of this report.

For further information see circular letters of instruction from the Traffic Manager.

True Size—6x10½ In.

MICHIGAN
STATE ADMINISTRATIVE BOARD
TRAFFIC DEPT.

DAILY CAR RELEASE REPORT

FREIGHT N. R. New York Central DATE March 16 1927 STATION Brooklyn

INITIAL	NUMBER	RELEASED DATE	A. M.	P. M.	REMARKS
M.C.	52073	3/16		5-	Empty - Cement
N.Y.C.	12082	"		5-	" Sand
N.Y.C.	15891	"	11-		" Gravel

I HEREBY CERTIFY THAT THE ABOVE CARS WERE UNLOADED AND READY FOR MOVEMENT AS STATED ABOVE.

INSTITUTION State Construction Div.
BY John Doe
TITLE Yard Checker

True Size—8½x5¾ in.

sheet is earth excavation. You will notice that both the daily expenses connected with moving dirt, and its respective daily unit cost, and the accumulated expenses under labor, equipment rental, dynamiting, supplies, and overhead are kept. When a new job is started, we begin moving in earth-moving equipment. This cost of moving in equipment is balanced against the total yardage on the job, which on this cost sheet happens to be 10,744 cubic yards, and the unit per cubic yard of $.007 is established. I wish to mention that this unit is not correct for any given job, and is nothing but a set of figures. Each day that the crews move dirt this amount of dirt keeps increasing in the column headed "Total To Date—Quantity Work Done," and the respective charges, such as labor, equipment rental, dynamiting, supplies, overhead and winter overhead, keep increasing. In this way, I watch the various units of work fluctuate from day to day as the work is being done. We also show our budget quantities and the bid price opposite our total cost to date.

On many of our jobs, we include clearing and grubbing in our bid price on earth work. These jobs, of course, are jobs where clearing and grubbing do not amount to very much. On some jobs we include our borrow excavation in with our earth work excavation and bid it in under one price. When we do this, we keep a total on the daily unit cost sheet of the earth work, plus the borrow, plus the clearing and grubbing, and this total unit cost is balanced against our budget unit price. The same system is used on laying pavement—that is, the daily costs are kept under different classes of work and the accumulated costs are kept in the right hand column of the sheet.

Cost Classification.—The following cost classification chart that we got out when we first started this cost system has been deviated from somewhat, but generally speaking, we are still following the items as given:

MICHIGAN STATE HIGHWAY DEPARTMENT

State Construction Division

Field subdivision and explanation of cost clasification chart for Department Construction Account No. 79-7.

NOTE: All Rentals where equipment alone constitutes the rental, shall be set up under Equipment Rentals. This applies to equipment rented from State Equipment Division or to any other equipment rented from another party.

All Rentals where men constitute part of the equipment rental, such as man and team, man and truck, etc., shall be set up under labor.

Item 1. Under Drainage

Tile underdrains, sewers, catch basins, manholes, etc.

A. Labor: Includes all labor involved

Michigan State Highway Construction Division

DAILY TRUCK REPORT

(TURN IN TO TIMEKEEPER DAILY)

DATE 8/26/27 TRUCK NO. 21 DRIVER J. Horner

Hauled from Job No.	Time Arr.	Time Left	Hauled to Job No.	Time Arr.	Time Left	Tons or Yds. Hauled	Material Hauled	Gas, Oil, Grease, small repairs, etc.	Amount	Classification
8		7	12	10	10:30	1/2 T	Steel	Gas 1.80	2.80	10-E
8	1	3	14	.6			Tile	Oil .50	4.00	1-B
									6.80	

Total Time 10 Hrs. Rate .45 Amount 4.50 Total Expense 2.30

CAUSE OF DELAYS.....

True Size—8½x5 in.

in laying tile sewers, building catch basins and manholes, etc.

B. Materials: Includes cost of all materials involved in laying tile and sewers, building catch basins, and manholes and all transportation cost om materials to the job, such as cartage and freight.

C. Equipment Rental: Includes the rental cost of all state owned equipment or rental of equipment from any other source.

D. Supplies: Includes such items as gas, oil, grease, small repairs, tools, etc.

Item 2. Culverts

Encased tile, reinforced concrete pipe, corrugated metal pipe, box culverts, headwalls, slab and T-Beam culverts, etc.

A. Labor: Includes all labor items involved in the work of Borrow Excavated metal culverts, building box culverts, headwalls, slab or T-Beam culverts.

B. Materials: Includes cost of all materials involved in building culverts, such as cement, aggregates, steel, forms, etc., also cartage or freight to the job.

C. Equipment Rentals: Same as under Item No. 1-B.

D. Supplies: Same as under Item No. 1-D.

MICHIGAN STATE HIGHWAY DEPARTMENT
STATE CONSTRUCTION DIVISION

MECHANIC'S DAILY REPORT

THESE REPORTS MUST BE TURNED IN TO OFFICE DAILY

NAME J. B. Williams DATE 8/20-27

Machine Name and No.	Description of Work	Office Use Hrs.	Rate	Amt.	Job No.
	Truck and Equipment Repairs				
Mixer #10	Replacing 2 Bearings in Motor	10	.52	5.20	9
	Miscellaneous Work				

OFFICE USE—REMARKS

True Size—8½x6¾ in.

Item 3. Earth Excavation

A. Moving of Grading Equipment: Includes actual cost of moving any equipment to the job such as labor, freight, cartage, supplies, etc.

B. Labor: Includes all labor items, involved in the work of earth excavation, such as men, teams, hired trucks, etc.

C. Equipment Rentals: Same as under Item No. 1-B.

D. Dynamiting Sink Holes: Includes all labor, dynamite, caps, fuse and other supplies necessary.

E. Supplies: Same as under Item No. 1-D.

Item 4. Borrow Dirt

A. Labor: Includes all labor items involved in the work of Borrow Excavation, such as men, teams, hired trucks, etc.

B. Equipment Rentals: Same as under Item No. 1-B.

C. Purchase Price of Dirt: Price per cubic yard at the borrow pit.

D. Supplies: Same as under Item No. 1-D.

Item 5. Overhaul

A. Overhaul: Overhaul allowance same as given on budget. Field cost will not be kept separate from grading

MICHIGAN STATE HIGHWAY DEPARTMENT
CONSTRUCTION DIVISION

MATERIAL CHECKERS DAILY REPORT

Yard Dixon Project No. K 5 Date 8/24/27

Serial Number—First Ticket Issued this date 21968

Serial Number—Last Ticket Issued this date 22112

	This Date	Total Previous	Season Totals
Number of Batches Issued	144	13000	13144
Number of Batches Delivered to Mixer	144	12986	13130
Number of Batches Delivered Not Used	---	14	14
Batches not Delivered (lost in transit, etc.)	0	0	0

BATCHES ISSUED—NOT DELIVERED			BATCHES RECEIVED—ISSUED PREVIOUS		
Ticket No.	Driver	Batches	Ticket No.	Driver	Batches

J. Yates
Yard Checker

True Size—8½x11 in.

but unit price allowance in budget will be deducted from Excavation cost.

Item 6. Loose Rock Excavation

A. Labor: Includes all labor items involved in the work of Rock Excavation, such as men, teams, hired trucks, etc.

B. Equipment Rentals: Same as under Item No. 1-B.

C. Supplies: Same as under Item No. 1-D.

Item 7. Removing Old Pavement

A. Labor: Includes all labor items involved in the work of removing and disposing of old pavement, such as men, teams, hired trucks, etc.

B. Equipment Rentals: Same as under Item No. 1-B.

C. Supplies: Same as under Item No. 1-D.

Item 8. Fine Grading

(Only when an item for same is in budget)

A. Labor: Includes all labor items involved in the work of Fine Grading, such as men, teams, hired trucks, etc.

B. Equipment Rentals: Same as under Item No. 1-B.

C. Supplies: Same as under item No. 1-D.

Item 9. Clearing, Grubbing and Cleaning Up Roadsides

A. Labor: Includes all labor items involved in the work of clearing, grubbing, cleaning up roadsides, such as men, teams, hired trucks, etc.

B. Equipment Rentals: Same as under Item No. 1-B.

C. Supplies: Same as under Item No. 1-D.

Item 10. Standard Pavement

A. Moving in Paving Equipment: Includes actual cost of moving all paving equipment to the job, such as labor, gas, oil, grease, freight, cartage, equipment rental, etc.

B. Trenching for Pavement: Includes all labor supplies and equipment rental involved in the trenching and preparation of sub-grade for placing pavement.

C. Laying and Maintenance of Water Pipe and Pump: Includes all labor supplies and equipment rental involved in laying, operating and maintaining water line and pump.

D. Setting Forms: Includes all labor supplies and equipment rental involved in setting up forms. This includes moving of forms from place to place along pavement area.

E. Hauling Aggregate to Mixer: (Trucks) Includes all labor, equipment rental, gas, oil and supplies involved in hauling aggregates to mixer by trucks.

F. Hauling Aggregate to Mixer: (Industrial) Includes all labor equipment rentals, gas, oil and supplies involved in hauling aggregates to mixer by Industrial Railway; also includes laying and maintenance of track.

G. Mixing, Placing and Finishing Concrete Pavement: Includes all labor, equipment rental, gas, oil and supplies involved during the mixing, placing and finishing of concrete pavement.

H. Curing Pavement: Includes all labor, equipment rental, gas, oil and supplies involved during the curing of the pavement, such as sprinkling, placing burlap or other means and the covering and uncovering of pavement.

I. Materials: Includes cost of all materials, freight and demurrage. Unloading will come under yard operation item.

J. Shouldering: Includes labor, equipment rental and supplies involved in finishing up the shoulders, men, teams, hired trucks, etc.

L. Yard Set Up: Includes all labor, equipment rental, materials, gas, oil and supplies involved in setting up the loading yard, also moving in of equipment.

M. Yard Operation: Includes all labor, equipment rental, gas, oil and supplies involved in operating the loading yard and covers unloading and handling of materials in yard.

Item 11. Reinforced Pavement

A. Mixing, Placing and Finishing Concrete Pavement Reinforced: Includes all labor involved during the mixing, placing of steel and finishing of concrete pavement reinforced. Also supplies as under Item No. 1-D.

B. Materials: Includes cost of all materials, freight and demurrage at the job.

Other items of unit cost involved as under Item No. 10 to be secured by adding to No. 11 the completed quantities of No. 10. The field costs must be kept under the items of No. 10.

Items 12 and 13. For Asphalt Work Only

Item 14. Guard Rail

A. Labor: Includes all labor involved in the placing and finishing up of Guard Rail.

B. Materials: Includes cost of all materials involved at the job, including hauling.

C. Equipment Rentals: Same as under Item No. 1-C.

D. Supplies: Same as under Item No. 1-D.

Item 15. Seeding

A. Labor: Includes all labor involved in the work of seeding.

MICHIGAN STATE HIGHWAY—CONSTRUCTION DIVISION
DAILY REPORT OF GAS—OIL—GREASE—ALCOHOL DISBURSED

Field Office Leslie Date June 5, '27

EQUIPMENT Name and No.	GASOLINE		OILS		GREASES		ALCOHOL		Project Number	Classification
	Gals.	Amount	Qts.	Amount	Lbs.	Amount	Qts.	Amount		
Shovel #9	30	5.40	8	1.60	2	.60	---	---	K-1	3-E
Mixer #13	26	4.70	2	.40	---	---	---	---	K-1	10-G
Finisher #21	11	1.98	1	.20	---	---	---	---	K-1	10-G

Correct J. Clew
TIMEKEEPER

True Size—8½x11 in.

B. Materials: Purchase price.

C. Equipment Rentals: Same as under Item No. 1-C.

D. Supplies: Same as under Item No. 1-D.

Item 16. Sodding

A Labor: Includes all labor involved in the work of sodding, such as men, teams, hired trucks, etc.

B. Materials: Purchase price.

C. Equipment Rentals: Same as under Item No. 1-C.

D. Supplies: Same as under Item No. 1-D.

Item 17. Extras

A. Labor: Includes all labor involved in any special work.

B. Materials: Includes cost of materials entering into special work.

C. Equipment Rentals: Includes rental of equipment used in the work.

D. Supplies: Same as under Item No. 1-D.

Item 18. Overhead Expense

A. Labor: Includes labor item of Field Superintendent, General Foreman, office rentals, office help, etc.

All extra work is listed under Item 17, but we do not keep unit costs on extra work. Each item of extra work keeps accumulating until the work is done, then we submit a force account statement to the project engineer and he in turn puts through an authorization covering this particular work. When this authorization is approved by the Department it comes back to us and we credit same against our cost in our central office. We pro-rate our overhead per dollar spent—that is, Item 13 on the cost sheet is cleared out the first and fifteenth of each month.

The last item on the cost sheet shows our Department construction costs, less cement; then the number of barrels of cement, at the unit price; then the total construction cost to date. I might mention here that the State of Michigan manufactures and furnishes cement for all State projects, as a rule.

Field Reports.—Our foremen's daily report, Form No. 821.1, of which I am submitting two different copies that I have made up, is really our most important field form. These reports are made out by the various foremen every night when the day's work is finished, and are collected next morning by our field timekeepers. These timekeepers are trained as to the different classifications of work and are responsible for the reports they turn in. When we first started this system we used to send in to the central office the reports just as they came from the field foremen, but this was unsatisfactory for the reason that most foremen are poor writers and too much time was taken up in the central office trying to decipher what it was all about. Then we furnished typewriters to our field timekeepers and they now make an exact copy of the original report on the typewriter and send it to the central office.

We had considerable difficulty at first trying to get enough information on these daily reports so as to establish a daily unit cost on the various kinds of work. This is something that has to be given time and study, and will gradually be ironed out. Today, after a year and three months of this system we have little difficulty with any of the field reports coming in to us. In many cases the timekeepers make the report out for the foremen for the reason that they can make them out so much quicker, and in the form in which we want them made out.

You will notice in the upper right-hand corner they give the amount of work done; also the stationing on the job. Below this is listed the different kinds of equipment and its respective working hours. Below this are columns for supplies used on the various pieces of equipment, together with materials used. Below this the classification of work, the job number and the date are given. On the left-hand side we copy the names of each individual free man, together with his occupation, hours and rate. Below this we give the number of hours of inmate labor, which we use exclusively for common labor. I might state here that all labor, except skilled operators, finishers, form setters, etc., are prison inmates. We have two institutions in this State that furnish us with all the men we need. We actually buy this labor from these State institutions at the rate of thirty cents per hour. These institutions clothe, feed and shelter the inmates in road camps out on the job.

We have another report called the Daily Equipment Breakdown Report. This is made out by the operators of the various pieces of equipment. The report is self-explanatory, and from it we keep a record of each piece of equipment as to the number of breakdowns, and the total hours lost.

We have another report called the Daily Truck Report which is made out by all men driving State-owned trucks—that is, hauling equipment from job to job and hauling supplies and miscellaneous articles.

We have another report which is made out by the yard checker who works under our timekeepers, called the Terminal Yard Report. This report is also self-explanatory as to its use.

We have another daily report called the Daily Car Release Report, which is made out each day by the yard checker and is used to control the incoming

Michigan State Highway Construction Division

DAILY MIXER REPORT

Project No. .....

Mixer No. 5 Date July 9, 1927

Total length to be poured by this mixer 10685 Lin. ft. 2.02 Miles—Sta. 97+50 to Sta. 204+35

Previously reported 1576 Lin. ft. Material located at

Poured this date 532 Lin. ft. Yard Plant

Total poured 2108 Lin. ft.

Poured today—Sta. 113+26 to Sta. 118+58 *Men used 27

Poured today—Sta. ..... to Sta. ..... Men used .....

(*) Total number of men for paving, curing, forms and fine grading between forms.

CEMENT

Amount of overrun or underrun 3 Bags {overrun / ~~underrun~~}

Causes:— .....

DELAYS OF MIXER

Note:—This information is very important. Give every reason for delays on each mixer and itemize each one; also length of time of each delay.

Broken gas line	30	min.
" hose con.	20	"
Total	hrs. 50	min.

Remarks .....

Weather Clear - warm C. Smith Inspector

True Size—8½x11 in.

M 034-17 C1

	Date	Vendor	Po. No.	Vo. No.	Free Labor	Teams Trucks	Inmate Labor	Equip. Rental	Supplies	Material
1		Brought Forward			2500546	3764247	2353176	811259	1945803	4249406
2	3/10	Pay Roll			4360					
3	"	Imprest Cash	#10						780	
4	"	Marshall Wright	C-0145						146	
5	"	Pay Roll				141 50				
6	4/1	Pay Roll					5654 0			
7	4/1	U.S. 66 A	#31					451 60		
8	4/2	Lamar Pipe & Tile	C-0188							452 63
9										
10										

True Size—9¼x11⅞ in.

	Date	Vendor	Po. No.	Vo. No.	Free Labor	Teams Trucks	Inmate Labor	Equip. Rental	Supplies	Material
1		Brought Forward								
2										
3										
4										
5										
6										
7										

True Size—9¼x11⅞ in.

MICHIGAN STATE HIGHWAY DEPARTMENT
CONSTRUCTION DIVISION
DAILY COST LEDGER

Length 5981 Class and Width 20' 2-Lane

County 2 Truck Line M-43 Project M 034-17 C1

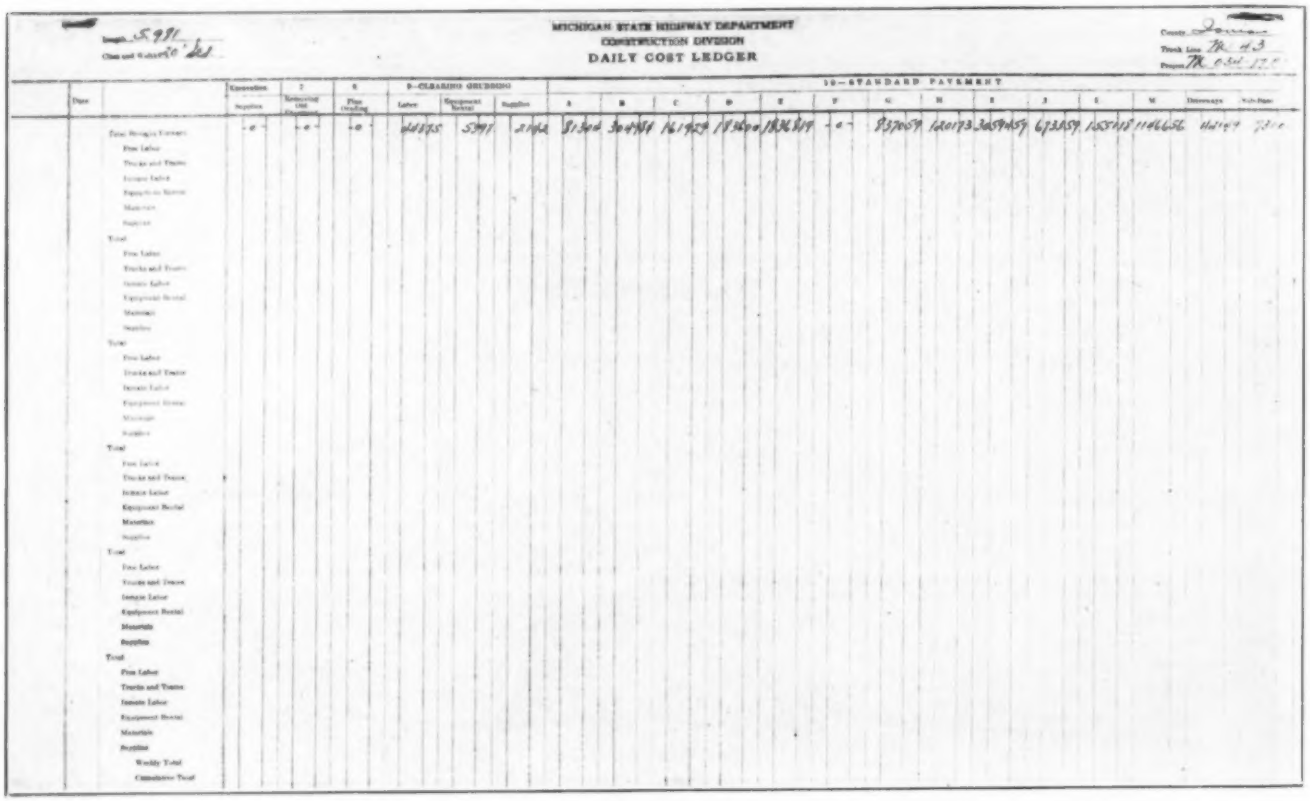
Date		1—UNDER DRAINAGE				2—CULVERTS				3A	3—EARTH EXCAVATION			3D	5—BORROW				5	6—LOOSE ROCK	
		Labor	Materials	Equipment Rental	Supplies	Labor	Materials	Equipment Rental	Supplies	Moving Equipment	Labor	Equipment Rental	Supplies	Dynamiting	Labor	Equipment Rental	Purchase Price	Supplies	Overhead	Labor	Equipment Rental
	Total Brought Forward	1956245	226718	5365	51544	374680	318346	168743	46344	6254	4316385	3411849	2523878	-0-	22635	125	-0-	-0-	346757	-0-	-0-
	Free Labor																				
	Trucks and Teams																				
	Inmate Labor																				
	Equipment Rental																				
	Materials																				
	Supplies																				
	Total																				
	Free Labor																				
	Trucks and Teams																				
	Inmate Labor																				
	Equipment Rental																				
	Materials																				
	Supplies																				
	Total																				
	Free Labor																				
	Trucks and Teams																				
	Inmate Labor																				
	Equipment Rental																				
	Materials																				
	Supplies																				
	Total																				
	Free Labor																				
	Trucks and Teams																				
	Inmate Labor																				
	Equipment Rental																				
	Materials																				
	Supplies																				
	Weekly Total																				
	Cumulative Total																				

True Size—22x13 in.

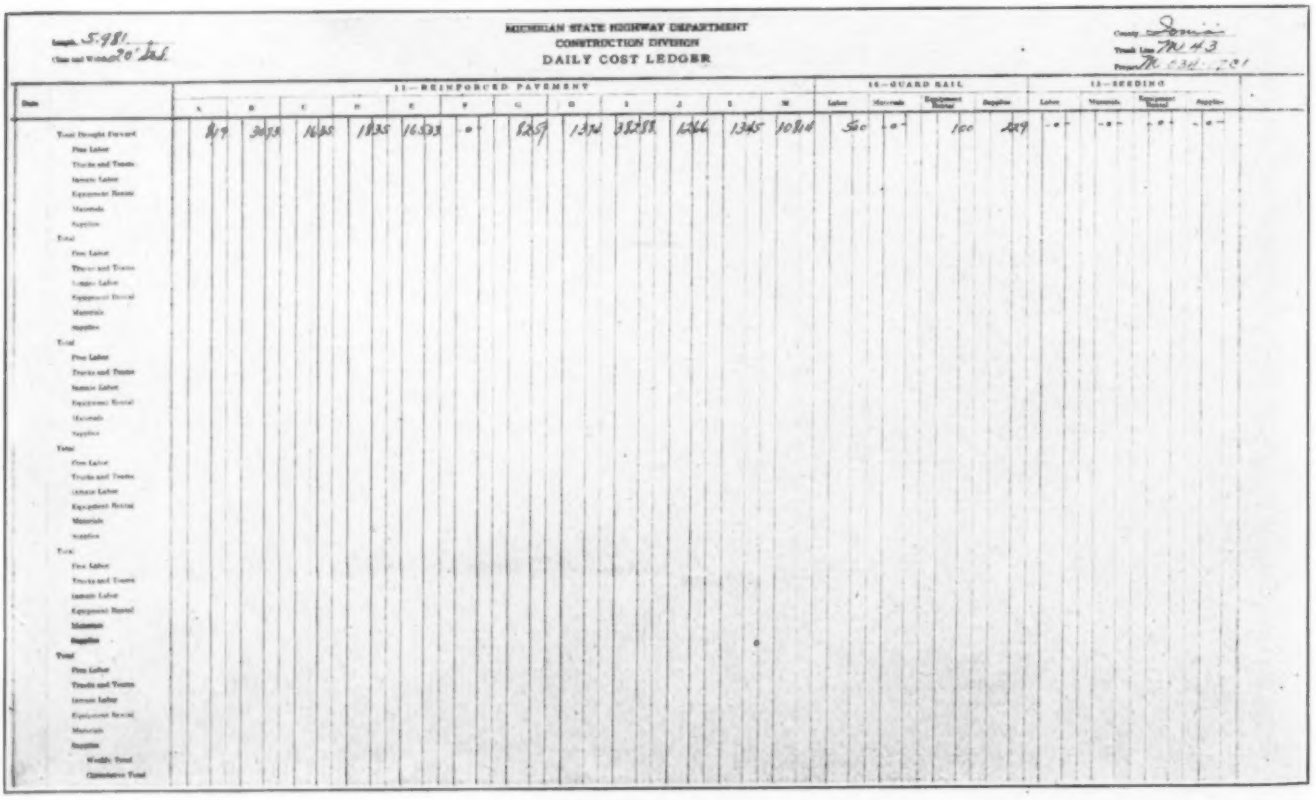
cars and the date and time they are released to the railroad companies.

We also have a report for our yard mechanics. Whenever they are assigned a certain job preparing equipment they are required to make this report out in detail in order that this cost may be properly classified.

We have another report on the hauling of batched aggregates to the pavers from the yard. We use serial numbered batch haul tickets for all of our material hauling, and each day a summary report, which is the material checker's daily report, is made out and sent to the central office, together with the various other reports. In this way we keep track of the number of batches


MICHIGAN STATE HIGHWAY DEPARTMENT
CONSTRUCTION DIVISION
DAILY COST LEDGER

True Size—22x13 in.


MICHIGAN STATE HIGHWAY DEPARTMENT
CONSTRUCTION DIVISION
DAILY COST LEDGER

True Size—22x13 in.

MICHIGAN STATE HIGHWAY DEPARTMENT
CONSTRUCTION DIVISION
CLASSIFICATION LEDGER
MATERIALS

Project M 034-17 C1

Date	Voucher	Order	Number	6" Vit. Tile			8" Vit. Tile			10" Vit. Tile			12" Vit. Tile			Culvert Pipe			Misc. Tile		
				Quantity	Unit	Cost	Quantity	Unit	Cost	Quantity	Unit	Cost	Quantity	Unit	Cost	Quantity	Unit	Cost	Quantity	Unit	Cost
3/1	Brought Forward			4160	ft	3396.7	3300	ft	46332	700	ft	12218	90	ft	2102			47100			4564
3/10	Lumber Sup. & Tile Co.	C-0188		532	ft	47.60															

True Size—10¾x17 in.

issued from the yard and the number of batches delivered to the mixer, which is determined by the number of batch haul tickets signed up for by the mixer foremen. In this same report we also keep track of the number of batches delivered but not used; also any batches lost in transit.

The problem of keeping track of the various items, such as gasoline, oils, greases, alcohol, etc., has been quite a problem to us. We have had considerable trouble trying to find out where all this stuff goes to on a job. We buy this stuff in huge quantities and every gallon must be accounted for by the field timekeepers. We usually have a gasoline pump stationed in the loading yard on a job and a record is kept by the timekeeper of the supply tank of this pump. A similar method is also used on oils and greases. The timekeeper reports each day on Form 814.2 the number of gallons of gas, oil and grease, together with their project number and classification for individual piece of equipment, and it is up to him to see that he checks up once each month on this item of cost. I know that many times the timekeepers have to guess at just where the gas and oil goes to on a job, but they, as a rule, keep pretty close check on this amount.

Another report that is really a part of the engineering organization instead of the construction organization is called the Daily Mixer Report. This report is sent in each day by the paving inspector and shows the number of lineal feet of pavement poured on a certain day, together with the stationing, amount of cement used—such as overrun or underrun, and various delays to the mixers. This report, however, is not used for cost data information, but is used only to keep a tab on how much pavement is poured, together with the overrun and underrun of cement.

Office Forms.—A form called the Daily Cost Ledger, which you will note upon examination bears the same classification numbers as the small field classification chart, contains the same information as the Daily Unit Cost Sheet, only it is a large ledger book where all accumulated costs under the various classifications of work are kept. You will note there is space for six days' work on each sheet, and is separated into labor, trucks and teams, inmate labor, equipment rental, material and supplies. This cost ledger is the book from which our daily unit cost sheets are made up.

We have another ledger called our Control Ledger. This ledger must balance once a month with the State Administrative Board books, from which all State expenses are paid. When a

STATE ADMINISTRATIVE BOARD
TRAFFIC DEPARTMENT
LANSING

CAR REPORT AND OFFICE RECORD
OF OPERATIONS AT

DATE

WEATHER CONDITIONS A. M. P. M.

Shipper's Date	Purchase Order	Shipper	Shipping Point		Car Initial and Number	Kind	Contents	Weight	Charges	Freight Bill Date	Freight Bill Pro	Destination	Consignee's Permit Date	Consignee's Permit Time	Released Date	Released Time		Demurrage Agreement	Remarks and specifications of shortages or re-loads as reported on order
3	14	Thomas	Thomas Gravel Co.	Mich.															
"	10	"	"	"															
"	9	"	"	"															
"	6	Copeland	Mich. State Forestry	"															
"	7	MPC	Mich. State Highway	"															

To record to make out in Duplicate - Original being sent to Traffic Manager's office - Copy remaining in Construction Division office for records.

Tons Coal on Hand
Tons Coal Received
Total
Tons Coal Used
Balance on Hand

INSTRUCTIONS—Symbols under "Remarks" whether car is unload or not back is due to shipper's order or carrier's carelessness or error.
If boxcars are off on by months.
A separate report must be prepared in duplicate by use of carbon paper for each day's receipts. When completed mail original to Traffic Manager. Special other must be reserved to retain all railway equipment within the free time allowed. See Traffic Manager's circular letters for further instructions pertaining to transportation matters.

True Size—17x11 in.

new job is started the budget is set up for that job on the Administrative Board books, and each day that expenses are made against that job these expense vouchers must go through the Administrative Board for payment, and are charged against said budgets on their books. This is one item that we have to contend with that an individual concern or contractors do not have to watch as closely as we do. Sometime later I will go into detail in regard to the connection between the State Construction Division and the State Administrative Board with regard to classification of expenditures.

We have another ledger in our central office for materials. This ledger is set up according to project numbers and contains all of the materials, together with the vendor's name, the purchase order number and the voucher number, quantity, unit price, and the cost. It is more or less made up from the engineer's semi-monthly estimate. In other words, his estimate states the number of feet of certain size tile laid. This amount of tile is charged against that job at the unit price upon which it was bought. A similar ledger is kept of all the supplies. These two ledgers are kept in detail as to the classifications and are in turn transferred to the control ledger which is balanced against the Administrative Board books.

We have a man in the central office who takes care of all incoming cars of sand, gravel, tile, etc. He does nothing but keep track of all the material entering the various yards, together with the dates of the car releases. This, however, is enough to keep a good man busy every day when you consider the thousands of cars of material we use each year.

In this central office of ours one man receives all the mail. We have three men who make up the daily unit cost sheets on the various jobs. Each man has a certain number of jobs to take care of and is responsible to the extent that his control ledgers must balance at the end of each day's work. He receives the foremen's daily reports the second day after the work was performed, and builds up a daily unit cost sheet from that. These cost sheets are then given to the group of girls who type them up and send them to the office of the General Superintendent of State Construction. He receives these cost sheets approximately the fourth day after the work was performed. These daily unit cost sheets are also sent out to each one of the job superintendents. In this way they have an opportunity to see just how their jobs are going as regards cost, and are thereby able to make what corrections and suggestions they see are necessary.

About four times a year we prepare a special cost sheet which is made up from a special estimate made by the project engineer and submitted to the central office. From these special estimates we make up a cost sheet which shows with just what degree of cost our jobs are progressing. On this special cost sheet each item of work is itemized in detail, and the total cost compared with the total money credit allowed by the engineer. From this we tabulate on one sheet all of our live jobs and can tell how much in dollars and cents we have made or lost on each job along with the total.

This article just states in a brief way our system, together with a brief statement of the various forms that we use, of which there are quite a few. We have thought many times of cutting down the number of field reports and each time we attempt to do this we encounter the difficulty of getting the cost information in detailed form by using only a few field reports. We have come to the point where we believe it is easier and better to make out one report for each portion of the work and have that report legible than to have one report covering many operations of work which might cause confusion for the men in our central office making up our daily cost sheets. I have seen many cost systems used in this country by private individuals and firms which are much smaller, or rather they use less field forms than we do; but our connection with the State Highway Department is of a different nature when we consider that we must balance all our cost figures against the books of the Administrative Board controlling all expenditures of the State departments. If it were possible for us to pay all our own bills it would simplify our cost system enormously, but, on the other hand, this would not be good business practice by the State.

Going back to the item of paving, notice that our paving costs are kept under various headings, as shown on this sample daily unit cost sheet. Under each one of these headings we have a foreman and he makes out individual reports for his part of the work. Wherever we have reinforced pavement on a job we pro-rate our costs against the number of square yards of reinforced pavement laid, so that we have the same unit under trenching for standard pavement as we have under trenching for reinforced pavement. The only unit that differs is the materials.

The item of overhaul is handled in this way: All overhaul quantities allowed by the engineer are figured at the bid unit price and subtracted from our earthwork labor cost, also equipment rental cost, and is set up on the cost sheet so that the unit cost is the same as the unit price bid. We have no way of keeping field costs on overhaul.

Curing Concrete at Phoeniz, Ariz., by Hunt Process

The city of Phoenix, Ariz., after voting funds for rehabilitating its street railway, drew up specifications for concrete, allowing as an alternate the Hunt process of curing. This alternate curing method was selected by the successful contractor. We are indebted to November Arizona Highways, the official publication of the state highway department, for the following account of the results of the tests relating to this method of curing:

"For our own information and in conjunction with the city, cores were drilled in some of the completed work, and tested in our laboratory. Seven cores were taken as near to the seven-day period as possible, usually the day before to allow time for capping. They were capped with neat cement, and broken without being immersed as called for in A.S.T.M Standard specification C42-27 but were corrected for height. The mix was 1:2:3½, using a very excellent washed sand and gravel. Results on cores taken at 7 days are as follows:

	Breaking load lb. per sq. in.
1	2,945
2	3,544
3	2,815
4	2,498
5	3,033
6	1,933

"It was the intention of this department to take 20-day cores, but for various reasons they were not taken until the pavement was from 36 to 42 days old. These cores were capped with neat cement, immersed in water for 48 hr., and corrected for height, as specified in A.S.T.M. Standard specifications C42-47 with the following results:

	Breaking load lb. per sq. in	Age, days
1	3,931	42
2	4,742	41
3	3,593	39
4	4,355	38
5	4,478	37
6	3,931	35

"All cores were taken with an Ingersoll Rand Calyx drill and were approximately 4⅜ in. in diameter. From the time this pavement was laid until the last cores were taken there was recorded only .09 in. of rainfall, and the daytime temperature maximums were all well over 100° F., and the nighttime minimums never falling below 70° F.

"The above results would indicate that this method gives very effective curing."

Cook County, Illinois, to Have 65 Miles of 40-Ft. Roads.—The Illinois State officials and the officials of Cook County, Illinois, have agreed on a program whereby Cook County is to have 147 miles of new roads, which are to be built or contracted for this year at state expense. Moreover, 65 miles of these highways are to be 40 ft. wide.

Gravel Roads in Province of Nova Scotia

Methods of Construction and of Maintenance

By R. W. McCOLLOUGH
Chief Engineer, Department of Highways of Nova Scotia

WHILE I have been asked to speak on construction, our problem is usually one of reconstruction, or improvement. Unfortunately, we in the older provinces seldom have the opportunity of locating, and constructing, a highway where none previously existed. In most cases, we have to improve an old road, which has very often been improperly located, and, in some instances, has developed from a path. It is essential before finalizing the alignment, grades, width, etc., that we try and arrive at some idea of what traffic the road will carry in the future, and then construct the road to a standard that will serve the traffic for a reasonable period of years.

If the grading is in flat country, where very little rock is to be encountered, it can be carried out at a low cost by the use of the blade grader and the elevating grader with heavy tractor-power units, motor trucks and motorized scrapers for making the fills. If the work is in hilly or rough country, the caterpillar shovel, air compressor, tractor and motor truck are required. Without modern machinery, quantities cannot be moved on highway construction at a low unit cost.

Subgrade Preparation.—Before the road surfacing is placed on the subgrade, it is essential that the subgrade be carefully reshaped, preferably with a blade grader. All unevenness, bumps, depressions and ruts must be eliminated, and the roadbed made to conform absolutely to the cross section required by the plans. It is not only costly but difficult to remedy a bad subgrade with surfacing material, and obtain a smooth surface on the completed roadway, unless the subgrade has been so completed. It will usually be found necessary to reshape the subgrade immediately ahead of the surfacing owing to the roughening action of traffic.

There are three principal types of cross section used for gravel surfacing: The feather edge, the trench and the spill-over. The spill-over is a combination of the trench and feather-edge section. tI usually involves considerable extra expense to use the trench section or the spill-over section, and for that reason the feather-edge section is the most popular in Canada.

Placing Surfacing Material.—There is only one method of placing surfacing material which will give satisfactory riding qualities to the completed roadway, and that is to dump the surfacing from the vehicles either on the sides or in the center of the subgrade, and spread with a blade grader. The old method of dumping the material on the subgrade and spreading by hand invariably created a bumpy road. The action of the blade grader not only ensures an even distribution of the surfacing material, but tends to mix the various loads brought out from the pit, and it will usually be found that there is a variation in the material brought out. By mixing, the surfacing is made more uniform.

It is usually wise to begin the surfacing at the point nearest the source of supply, and to insist that the vehicles carrying the surfacing travel over the entire width, thus avoiding the rutting of the surfacing and producing a uniformly compacted surfacing over the entire width of the travelled way.

Gravel should not be bladed on the travelled way in such quantities as will inconvenience motorists by forcing them to drive through a considerable depth of loose material. The amount which can be drawn in at one time depends entirely upon the binding qualities of the surfacing material; usually about 2 in. in the first instance is sufficient. The use of road rollers adds considerably to the cost and generally the surfacing can be consolidated by the traffic without seriously inconveniencing the motorist.

Size of Gravel.—In order to reduce the cost of our surfacing we sometimes construct in two courses. The bottom course, which is usually about 4 in. in thickness, is required to pass a 1½-in. ring; while the top course, which is 2 or 3 in. in thickness, is required to pass a 1-in. ring. We prefer, however, to surface our highways with material of which all will pass a 1-in. ring. Some engineers now advocate that all material for surfacing should pass a ¾-in. ring. I believe this will produce surfacing which will give better riding qualities. However, it must be remembered that there is a considerable difference between the cost of producing material which will pass a 1-in. ring and that which will pass a ¾-in. ring.

In our first road construction in Nova Scotia we used gravel for surfacing which was practically pit run, and which contained in some cases, stones up to 3 in. in size. From this we passed to the screening of the material so that nothing was placed on the roadway which would not pass a 1½-in. ring.

Gravel Producing Plants.—Today we are crushing practically every yard of material which is being used on our highways. For this purpose, we are using specially designed modern portable crushing and screening plants where the material is available locally. We have in addition three non-portable crushing plants equipped with gyratory primary breakers and gyratory reduction crushers for the purpose of shipping material by rail to localities where no material is available locally. When we screen by hand or use small screening plants fed by horses with drag scrapers, we find that our cost when loaded in the vehicles is usually in the vicinity of 80 ct. per cubic yard. In addition to this, the oversized rocks, which really contain the best road material, are wasted, and as in most localities there is not an overabundant supply of surfacing material, it is necessary to conserve every pound.

While our larger portable crushing plants cost us in the vicinity of $19,000, we have been able to load material in the vehicles, crushed so as to pass a 1-in. ring, at a cost of less than 50 ct. per cubic yard; the actual cost of labor, fuel, etc., being less than 30 ct., and to which we add 20 ct. per cubic yard to cover the cost of depreciation on machinery. These plants have a capacity of from 150 to 300 cu. yd. per day, depending on the amount of oversize in the pit. The figure of 150 cu. yd. per day is for a pit which contains practically 100 per cent oversize.

All our plants, both portable and permanent, are equipped with drag lines, the bucket of which hauls material to the conveyors.

Our permanent plants have cost us in the vicinity of $30,000 each, but they are delivering material to the railway cars at a cost of less than 50 ct. per cubic yard, making allowances for all charges, including depreciation of machinery. As already stated, the permanent plants are equipped with gyratory crushers, and the cost of production will depend very largely on the amount of oversize in the pit and the hardness of the stone to be crushed.

Use of Clay Binder.—We find that many of the pits in Nova Scotia do not contain sufficient binder, and for this reason it is necessary to add clay, in order to produce a proper binding of the surfacing. Where the material in the roadway which is being graded is suitable for this purpose, we usually leave a windrow on each side of the subgrade. When about 3 in. of the surfacing has been placed, this windrow of clay or harpan is brought over the

surfacing with a blade grader; and, in most cases, we have been able to consolidate the gravel surfacing by this means. It, however, should be observed that an excess of clay binder is injurious to the surfacing in that it is liable to set too hard in dry weather and to become slippery in wet weather. We usually find that about 12 per cent is a sufficient volume of clay to add to the surfacing, and clay is only added when the qualities of the gravel are such that it will not consolidate without the addition of binder.

Hauling of Surfacing Material.—We formerly used to state that a haul up to two or three miles could be economically carried out with horses. I think, however, that it has been clearly demonstrated to all of us that the horse is not economical for any length of haul.

In Nova Scotia, while the Department owns a considerable number of two-ton trucks, we find that we do our cheapest hauling by using hired "Ford" and other light trucks. These trucks are owned by farmers and others in the locality and are hired by the Department at a rate of $1.00 per hour, including driver and all other charges. The trucks are only paid for the actual time which they work on the road. It may be said by some that it is not possible for truck owners to rent trucks at this rate. Nevertheless, more are offered to us in Nova Scotia at this rate than we require. This is probably due to the fact that the owner requires the truck for other purposes, and the money received for road work is usually clear gain. Very often the truck is driven by the owner's son, or his hired man.

With trucks hired at $1.00 per hour, we have found that where the haul exceeds five miles we have been able to haul material at a cost of from 18 to 20 ct. per cubic-yard-mile, with a proportionally higher charge for the shorter hauls; and here it may be mentioned that the cost of truck haul varies very considerably with the time of loading. For this reason, where the portable crushing and screening plants have been used, we have found that the cost of truck haul has been very much reduced owing to the fact that there is practically no time lost in loading. We also find that where any considerable number of trucks are employed it pays us to have a man to direct and look after them.

General Construction. — Satisfactory maintenance depends on proper construction. The elements of proper construction I have already touched on.

Deterioration of a gravel road can be averted only by vigilant maintenance. The riding qualities of a gravel road more than that of any other type are affected by the class of maintenance to which it is subjected. If perfect riding conditions are to be maintained, systematic maintenance is essential, and this means a patrol system. The length of the patrol depends upon a number of factors: Density of traffic; quality of surfacing material; climatic conditions, etc. The length will vary from three to six miles.

Proper equipment is the first essential of a satisfactory patrol. Maintenance work should be effected by machinery wherever possible, and the foreman or patrolman should be supplied with the necessary additional labor. The patrolman should not undertake heavy repairs; these should be left to a foreman with a special gang. In this way, the regular foreman, or patrolman, is enabled to attend to his ordinary duties.

Spring Maintenance.—In the spring of the year in this country, the surface of a gravel road, due to the action of frost and traffic, is usually rutted, and does not conform to the cross section to which it was constructed. If the spring maintenance is undertaken immediately after the snow leaves the travelled way for two weeks, the surface of the roadway, being plastic, can be re-shaped without difficulty, which condition is usually not true at any other season of the year. A dollar spent at this season of the year will accomplish more than three dollars can perform a month later. For these reasons, in Nova Scotia our first step in the maintenance of our gravel roads is completely to rip up the surfacing down to the subgrade. For this purpose we use our 10-ton tractors and 12-ft. blade graders. This work usually requires from five to nine cuts of the blade grader. The first cuts are usually made along the center of the roadway, practically the entire surfacing being turned out to the shoulders. The material is brought back by the side cuts, and the roadway made to conform to its proper cross section. The patrolman, therefore, is handed his section in perfect condition in which to begin his year's work, and he is expected to maintain it in this condition throughout the season. The result of this, our first step in our maintenance, is to regrade the gravel so as to bring a considerable portion of fines back to the surface and to eliminate all unevenness.

As some of the surfacing placed during our early construction contained many large stones, our first year's operation, as outlined above, entailed considerable work in throwing away the oversize, and in some cases we found it necessary to use a scarifier.

Our experience in road surfacing in Nova Scotia has taught us at least one thing, and that is that oversize material is absolutely useless in roadway surfacing, that the place to eliminate this is in the pit, and that the only safe and economic way of doing this is by the employment of modern crushing and screening plants.

There are three principal operations necessary to the keeping of an untreated road surface serviceable:

(1) Addition of new materials which are similar to those in the existing surface.

(2) Blading and dragging.

(3) Patching.

In addition to the foregoing, it may sometimes be necessary to scarify the surfacing.

Maintenance Material.—Formerly, we obtained our maintenance material by either hand screening or by using horses to drag-scrape the pit-run gravel to a trap and thence over a grizzly or to a rotary screen. This method was not only costly, but resulted in the loss of the hardest particles of stone. Today the greater percentage of our maintenance material is produced either by permanent crushing and screening plants or by portable crushing and screening plants.

Undoubtedly, the best time to apply maintenance material is in the fall and spring. This method, however, involves the stock-piling of the material on the roadway, owing to bad hauling conditions at this time of year, and there is also some objection to this owing to the extra cost of rehandling the material. It is, however, advisable to have a certain amount of material stock-piled along the roadway.

The kind of gravel used is an economic problem; the factors being durability and cost. It is understood, of course, that the material used must give satisfactory riding qualities. Extremely hard gravel does not make the best maintenance material. Ideal gravel for maintenance is one which is soft enough to break up sufficiently to supply fine material, but which will not produce mud, and has sufficient hard material to leave a light coat of free gravel of pea size on the surface. The amount of material which must be added yearly depends not only on the traffic carried and the climatic conditions, but also on the quality of the maintenance material. With a well-constructed roadbed carrying 700 to 1,000 vehicles per day, it will be found that an average of 200 cu. yd. per mile must be replaced each year. As there should always be a small reserve of gravel on the shoulders of the roadway, sufficient width for that purpose must be provided at the time of construction.

Blading or Dragging.—The blading or dragging of a gravel road can be attempted by so many methods, and some sort of results accomplished by each, that it is difficult to determine which is the proper course to adopt. The amount of traffic, climatic conditions, drainage, kind of sub-soil, width of road, equipment, funds available and characteristics of gravel at hand for repair, all have a bearing on the maintenance methods.

In Nova Scotia we are successfully maintaining gravel roads which have an average traffic of more than 2,000 cars per day during the summer months. When the traffic is this heavy, how-

ever, there is great complaint on account of the dust nuisance, and for this reason it is necessary to apply a dust layer of one kind or another. I, however, believe that when the traffic exceeds 1,500 cars per day, it would be more economical to construct a higher type of paving, and in this connection, I might point out that, where our traffic reaches 2,000 cars per day, our maintenance cost is approximately $1,000 per mile per year.

Continuous maintenance is essential on a gravel road. The old practice which had the farmer working on the roads when there was nothing else to do is wrong—not only economically, but from the viewpoint of maintaining proper riding qualities. Maintenance forces must be organized so as to give continuous service, and so as to keep the roads in repair at all times.

It is most essential that the gravel road be kept smooth continuously, and the work of keeping the road smooth should start at the time of construction. Once a gravel road is allowed to become pot-holed or rutted, it is beyond the stage where it can be cared for with the ordinary maintenance machinery, and it will then be necessary to bring in heavy machinery and perhaps resort to scarifying.

The method used for dragging the road will depend on the various conditions encountered. It is essential, however, that even the simple matter of dragging be given careful thought by some responsible official, and the methods used not left to the patrolman on the road. The ordinary layman does not realize the importance of trained personnel both in highway construction and maintenance. The idea that any laborer can do the work is wrong. The man on the grader must be properly instructed and then must be encouraged to plan his work and study the effectiveness of his methods.

The roadway should be dragged as often as may be necessary, regardless of weather conditions, to keep it smooth, and to maintain a coat of free gravel. The frequency depends not only on the volume of traffic, but also on the characteristics of the subgrade and the surfacing material. However, on an average, it is necessary to drag it after every 1,000 vehicles have passed. Operating road maintainers at a speed in excess of about three miles per hour is not only very detrimental to the machinery, but causes the machines to leap over the bumps instead of cutting them off. It is therefore, essential that maintainers be operated at a reasonable speed.

Acknowledgment.—The above is an abstract of a paper presented Sept. 26 at 15th Annual Meeting of the Canadian Good Roads Association.

Confusion from Traffic Signals Causes Many Deaths

Confusion among motorists and pedestrians, growing out of lack of uniformity in traffic regulations, caused the death of more than 2,000 persons during the year 1927, according to a report made public recently by the City Officials' Division of the American Road Builders' Association. Traffic violations caused, during the same period, a total of 2,353 fatalities and most of these, it is declared, were due to the widely divergent traffic laws in effect in the cities and states. In connection with its findings, the City Officials' Division, which is composed of the highway and traffic officials of the principal cities of the country, inaugurated a vigorous campaign for the adoption in all cities and states of the uniform traffic codes recently completed by the National Conference on Street and Highway Safety, sponsored by the Department of Commerce, the American Road Builders' Association, the Chamber of Commerce of the United States and numerous other organizations vitally interested in street construction and traffic regulation.

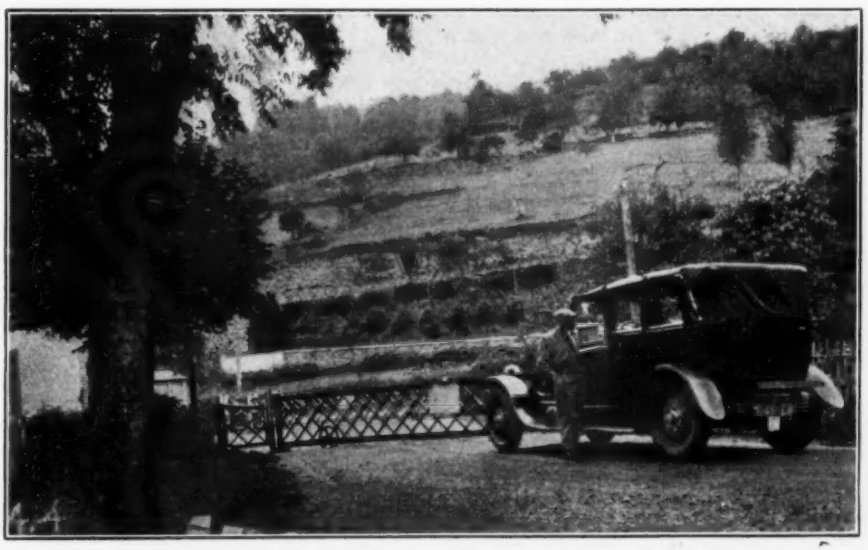
The control of modern traffic in American cities constitutes an extremely complex problem, the officials of the roadbuilders' organization point out. "The existence of widely divergent methods of signalling, turning and general traffic movement," it is asserted, "proves extremely confusing to motorists accustomed to different systems." This confusion creates a hazard having a most pronounced relation to highway accidents. Investigators find that the effectiveness of uniform ordinances governing the regulation of traffic has already been demonstrated. In one section of the country where uniform laws have been in effect for several years the number of highway accidents have been considerably less proportionately, than in the sections where there is a wider divergence in the codes that are in force.

"Not only will uniform traffic laws eliminate to a large extent the accidents resulting directly from confusion in traffic control methods," says the statement drawn up by officials of the City Officials' Division, "but they will also facilitate the movement of traffic in and between the cities."

"Practically the only deterrent to the adoption of the proposed uniform codes everywhere throughout the country, is the fact that traffic officials in some of the cities are confident that the system under which they have been operating is the best. Good traffic codes are undoubtedly in effect in many cities and in some cases a local situation necessitates traffic regulations that will cover conditions peculiar to a particular city. In general, however, the uniform codes can be adopted with economy and profit by all cities and states and with the clauses covering the peculiar local conditions remaining as they are."

The report of the Traffic Committee of the City Officials'. Division will be presented at the annual Convention of the American Road Builders' Association which will be held in Cleveland during the week of Jan. 14.

Speed Limits on England's Roads Increased.—The Ministry of Transport has issued an order increasing the legal speed limits on trucks and other commercial vehicles. The principal provision increases the speed limit on trucks equipped with pneumatic tires from 12 to 20 miles per hour.



How They Handle the Highway Railroad Grade Crossing in France

In France all grade crossings on highways are provided with gates. A dwelling house is built for a gateman at each crossing and the gates are operated by some member of the gateman's family. Quite frequently the gateman is otherwise employed most of the time and the wife or children tend to the opening and closing of the gate. By thus providing a comfortable house it is possible to secure the services of a gateman at a very low cost and while this method is not as satisfactory as a complete separation, the traveling public is well protected and the total cost is probably no greater than the interest charges on a grade separation structure.

Asphalt Cold Mixes for Re-surfacing Roads

Methods and Costs of New Product Explained

By ALLAN K. HAY

Engineer to Ottawa Suburban Roads Commission, Ontario

DURING the past few years the Ottawa Suburban Roads Commission has been developing the use of asphalt cut-back mixtures for construction and resurfacing of heavily travelled highways. These mixes are prepared and spread without heating, being composed of crushed stone and an asphalt cold-patching product and are used at certain locations where the size of the work is too small to attract bids from contractors building the more usual types of hot mixed pavements. In the summer of 1928 a distance of 2.6 miles was built on the Metcalfe Road, which forms a link on one of the main highways between Ottawa, the Canadian capital, and the New York State boundary. On account of the heavy tourist traffic it was desirable to build a type of surface which would not require motorists to detour.

The existing road was a penetration macadam in fairly good repair but having a wavy and irregular driving surface and width of only 15 to 16 ft. with heavy annual shoulder maintenance. This roadway was used as a foundation without scarifying in any way, but was first widened by the addition of a strip of concrete, 6 in. in depth, the new width attained being 18 ft. on straight road and 20 to 26 ft. on curves, of which there are many.

On completion of the widening 3x6-in. planks were set along the edges and the new surfaces spread and compacted in two courses, the lower course of about 1½ in. to 2 in. and the upper course of 1-in. depth after consolidation. On completion a seal coat of premixed sand and asphalt cold-patch was broadcasted and rolled over the finished pavement. Traffic was allowed to proceed through the work at all times.

Mixing Plant.—The mixing plant for this work is very simple and exceedingly economical in cost. It is in fact merely an extension of the practice of using a small concrete mixer for cold-patching on roadway repair work. The plant operated on this job consisted of a second hand steam-driven concrete mixer with a tilting drum having a capacity of about 13 cu. ft. of coarse aggregate, this being mounted below a substantial timber platform and near a stone crusher. In operation, crushed stone is conveyed from the crusher bins to this platform, is dumped into the hopper of the mixer, the requisite quantity of asphalt cold-patch is added and the mixer discharged into trucks below.

Asphalt cold-patching material was used, having a somewhat higher bitumen content than that commonly supplied for patching work.

All stone was crushed to pass a 1¾-in. ring and was separated into two sizes:

A, from ¾-in. to 1¾-in.

B, from ¼-in. to ¾-in.

the dust of crushing being also separated and not used in the mix.

Size A was used for the first course and size B for second course.

It will be noted from the above that no attempt was made to approximate a graded asphaltic concrete mix by the addition of sand or other fine material, as such a procedure is impractical with cold-mixes of this type. The whole process was based on the theory that stability in the finished roadway would be obtained by the mechanical interlocking of the individual stone particles in the same way as in penetration macadam.

The finished pavement was covered with a rich mix of cold-patch and coarse sand, spread and rolled to an amount just sufficient to fill the surface voids and thus waterproof the whole. This sand seal coat worked out at a weight of 12½ lb. per square yard, the total weight of the whole new pavement averaging 295 lb. per square yard. This amount was governed largely by the condition of the old foundation, surfaces of greater and of less unit weights having been laid on other roads. On work of this kind a surface treatment with hot liquid asphalt is usually applied one year after construction and produces a finished pavement which compares favorably in appearance with hot-mixed types. The Commission has built short stretches of similar roadway, some of which are four years old and are giving excellent service under heavy traffic and severe climatic conditions.

Cost per Mile

Widening old roadway with concrete	$1,240
Cold-mix surface	8,000
Grading (earth shoulders and embankment)	3,640
	$12,880

Cold-Mix Surface

		Cost per ton of mixed product	
(1)	Mixing:		
	Setting up plant	$0.057	
	Labor mixing	0.705	
	Asphalt cold-patch	1.467	
	Crushed stone and sand	1.300	
	Coal for mixer	0.032	
	Plant rental, overhead and sundries	0.193	$3.754
(2)	Cartage from mixer to road: (Average haul 1.3 miles)		0.340
(3)	Spreading and rolling:		
	Labor	$0.564	
	Plant rental, etc.	0.126	0.690
	Total		$4.784

At 295 lb. of cold-mix per square yard, this is equivalent to 71 ct. per square yard. The following data are pertinent to the above costs:

Ten hour day.

Foreman, 55 ct. per hr. Roller-man, 75 ct. per hr. Mixer operator, 50 ct. per hr. Labor at 40 ct. and 35 ct. per hr.

Crushed stone at contract price of $1.30 per ton delivered at mixer.

Cartage contract at 34 ct. per ton.

Asphalt cold-patch used at rate of 7 gal. per ton of mixed product and cost 23 ct. per Imperial gallon (not U. S. gallon) delivered in barrels at mixer about 11 mi. from R. R. siding.

Portland cement $2.55 per bbl. delivered on road.

Coal $9.50 per ton at mixer.

All material weighed on 10-ton platform scale located in quarry. Cost of weighing included.

Meetings of the National Highway Traffic Association

The following list of meetings of the above association have been announced. Programs can be obtained by addressing the Workshop, National Highway Traffic Association, 12 Dennison Bldg., 515½ Jefferson Ave., Toledo, O.:

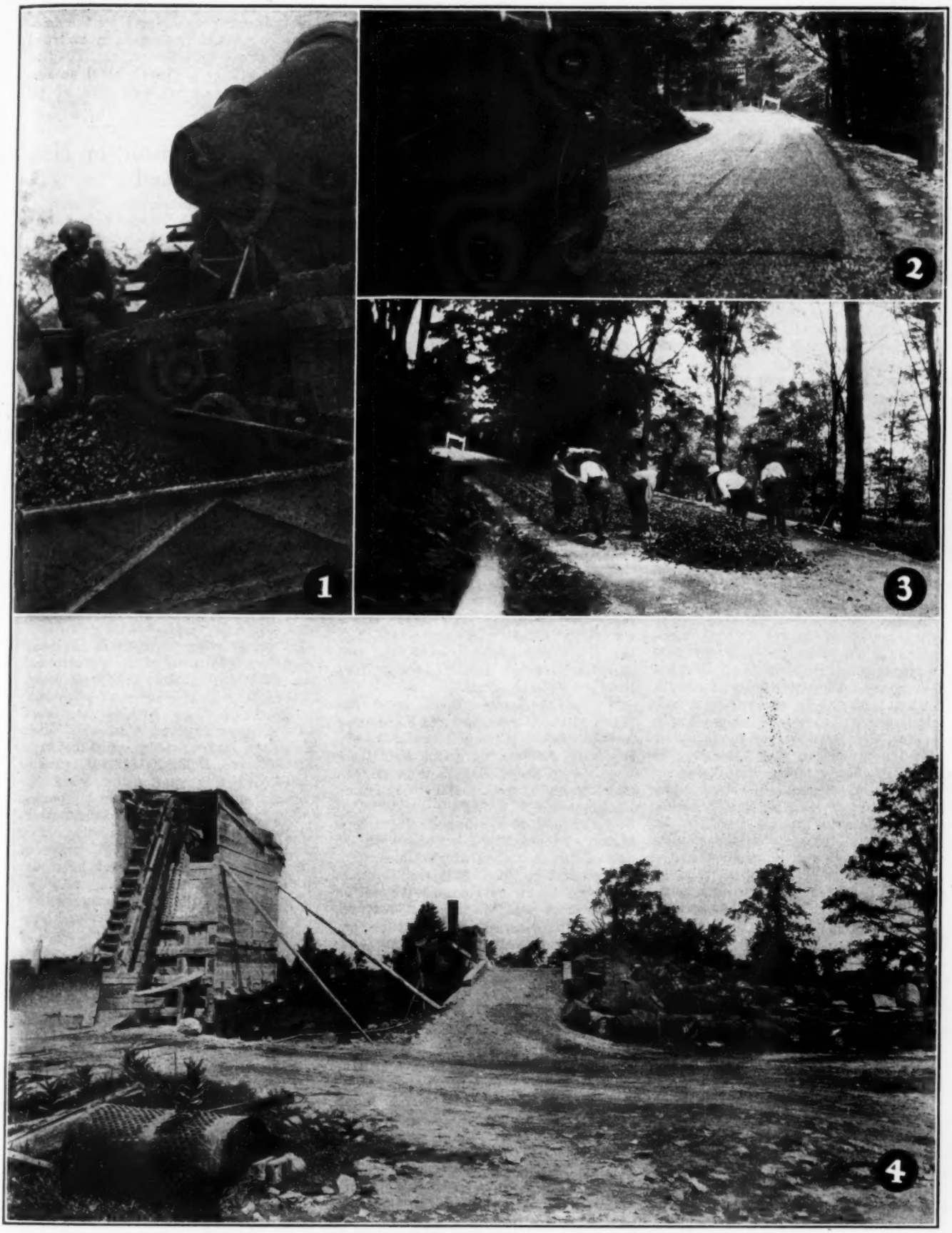
Dec. 3, 1928: Meeting of South Central Division of the National Highway Traffic Association, Hotel Roosevelt, New Orleans, La.; secretary, Elmer Thompson.

Dec. 10, 11 and 12, 1928: Annual meeting of the National Highway Traffic Association, Automobile Club of America, New York City; secretary, Elmer Thompson.

Jan. 15, 1929: Meeting of the North Central Division of the National Highway Traffic Association, Cleveland Hotel, Cleveland, O.; secretary, Elmer Thompson.

Jan. 17, 1929: Meeting of the North Atlantic Division of the National Highway Traffic Association, Automobile Club of America, New York City; secretary, Elmer Thompson.

May 13, 14 and 15, 1929: Annual convention of the National Highway Traffic Association, Stevens Hotel, Chicago; secretary, Elmer Thompson.



Pictures of Construction on Metcalfe Road by Ottawa Suburban Roads Commission

Fig. 1—Showing Use of Old Steam Driven Concrete Mixed for Preparing Cold-Mix Material. Fig. 2—Cold-Mix Surface Construction, Village of Radcliffe, in 1927, on About 10 Per Cent Grade. Fig. 3—Showing Spreading of Batches on Same Job as Fig. 2. Fig. 4—Showing Mixing Plant and Platform Over Mixer

26th Annual Convention and Exposition of American Road Builders' Assn.

It is expected that more than 30,000 people will be present at the 26th Annual Convention and Exposition of the American Road Builders' Association, which will be held in Cleveland, Jan. 14-18, 1929. This attendance will comprise highway engineers, officials and contractors from all states in the Union, as well as representatives and delegates from 28 foreign countries.

The program of the convention will consist of the reports of the various committees appointed from the seven divisions of the association.

On City Officials' Day, Captain H. C. Whitehurst, Assistant to the Engineer-Commissioner of Washington, D. C., will preside. The program will comprise the reports of the Committee on Administration, Organization and Finance; the Committee on Design and Construction of City Pavements and Streets; the Committee on Maintenance of City Streets; the Committee on Maintenance of City Streets and the Committee on Traffic Control. In addition to this, a special committee appointed for the purpose of studying subgrades and pavement bases in cities will make a progress report. Mr. C. A. Hogentogler of the Bureau of Public Roads is chairman of this committee.

City governments are undergoing a continuous change, but during the past few years there has been an indication of standardization of city government. This subject will be covered in a special paper presented by Mr. W. R. Hopkins, City Manager of Cleveland.

On Pan-American Day the program will be in charge of the Pan-American Division. Mr. Thomas H. MacDonald, Chief of the Bureau of Public Roads, and Mr. Octavio Dubois, President of the National Highway Commission of Mexico, will act as co-chairmen of the session. Papers will be presented by delegates from the Pan-American countries, setting forth the interesting facts of the road activities in their respective countries. A complete description of the Central Highway of Cuba will be presented; also a description of Federal highway construction in Mexico; a resume of the road activities in Canada and the financing of the system of roads in Chile. In addition to these, there will be several other interesting papers by the visiting delegates.

Special sessions which will include subjects of paramount importance in the highway construction field at the present time will be presented by the prominent contractors of the country.

On County Highway Officials' Day the program will consist of the reports of committees made up entirely of county highway officials and covering County Surveys and Planning; County Highway Construction; Rural County Highway Maintenance; Urban County Highway Maintenance; County Highway Legislation; County Administration; County Construction and Maintenance Equipment; and County Highway Finance. There will also be a special paper on the Procedure for Making an Economic Survey and Plan for County Highway Development.

A special committee on Grade Crossings, headed by Mr. E. W. James of the Bureau of Public Roads, will present its report. This report is of unusual interest to all engineers and officials, as well as representatives of railroads, for it will include the outstanding practices in grade crossing elimination and many other details necessary in the development of this item.

Recently there was held a joint meeting composed of committees of the American Association of State Highway Officials and the American Road Builders' Association, for the purpose of determining problems which could be considered cooperatively by the two associations. It was decided at that meeting to carry on cooperative work on national highway legislation and standardization of equipment; and also that it should be the policy for an officer of the American Association of State Highway Officials to present at the annual convention of the American Road Builders' Association a resume of the activities and achievements of the American Association of State Highway Officials during the past year. The two above-mentioned committees will meet on Monday, Jan. 13, to consider their subjects in detail.

Special headquarters will be established at the Convention and Exposition for the State Highway Officials, County Highway Officials, City Officials, Highway Contractors, Engineers and Officials, Manufacturers and Pan-American Divisions and the delegates are invited to make use of the headquarters thus placed at their disposal. There will be attendants in charge at all times.

The annual Road Builders' Banquet will be held in the Hollenden Hotel on Wednesday evening. Special features have been obtained to make this banquet highly interesting and an outstanding event.

The Road Exposition will be the largest of its kind ever held. Over 500 carloads of the latest improved road-building equipment and materials, occupying a space of almost 8 acres, will be on display for inspection and comparison. Much new development has been accomplished in the way of labor-saving equipment during the past year. Many manufacturers are bringing out for the first time new machines designed for the purpose of constructing better roads at lower cost. Much new maintenance equipment has also been developed during the past season and this will all be on display at the Road Builders' exposition.

The railroad companies have again granted reduced railroad fares to the convention. This reduction is based on the certificate plan and enables the delegates to obtain their return railroad tickets at one-half the price.

There will be sufficient hotel accommodations to amply take care of all delegates.

Road Development in New Zealand

The Prime Minister stated recently, according to a report from Trade Commissioner Julian B. Foster to the Automotive Division of the U. S. Department of Commerce, that in less than four years the Main Highway Board had assisted in constructing 450 miles of metalled roads, 240 miles of tar and bituminous surfaced road, 27 miles of concrete roads and over 4 miles of bridges. The expenditure in the same period, including the amount for 1927-1928, was nearly £3,260,000 ($15,768,350) of which £1,442,000 ($6,996,296) was for maintenance and £1,784,000 ($8,655,611) for construction. In addition the local authorities had spent £870,000 ($4,221,066) for maintenance and £725,000 ($3,517,565) for construction, making a total of £2,300,000 ($11,159,140) spent for maintenance and £2,600,000 ($12,129,500) for construction on the 6,400 miles of main highways, a grand total of £4,800,000 ($23,258,640) or £1,200,000 ($5,822,160) a year.

On roads other than main highway the net expenditures of the government was £2,698,280 ($13,091,315) of which £2,468,620 ($11,967,460) was spent for construction.

It was anticipated that the Main Highways Board would spend between £800,000 and £900,000 ($3,881,440 and $4,366,620) this year maintaining the primary and subsidiary main highways, and a similar amount on construction. Recommendations were also being made to add 800 miles to the 2,750 miles of subsidiary roads which had been declared main highways.

Main roads through all boroughs having less than 6,000 inhabitants had been declared to be main highways, so that from now on 10,000 miles of the country's road system had been brought under the benefits of the board's operations. The board was initiating plans for improvement in districts immediately surrounding all centers of over 6,000 inhabitants, but there were still about 35,000 miles of road which had to be maintained by the general taxpayers and the counties without help from the motorists.

The gasoline tax could greatly accelerate the road work. It would enable the board to give larger subsidies to counties adjacent to large centers of population which suffered from heavy motor traffic. The board had already approved subsidies of £3 to £1 for high class surfacing in the vicinity of Christchurch, Wanganui, Nelson and Hastings.

The Place of Highways in Regional Planning at Buffalo, N. Y.

How Erie County, N. Y., Handles Its Highway Problems

THERE are localities in which city planning and the construction of adequate highways in the surrounding territory are so intimately related that neither can be done efficiently unless they supplement each other. This applies particularly to the larger cities. New York, Buffalo, Detroit, Chicago and Los Angeles, together with many other expanding communities, have learned that the maximum of paved streets they are able to provide inside of the city limits does not meet the requirements of modern highway traffic unless such streets connect with a sufficient number of properly built highways in adjacent areas.

City planning, therefore, has become regional planning, and this applies not only to highways but also to water and sewer lines, police protection, zoning, and many other details of public service in which cooperation is invaluable.

Motor traffic has become so tremendous in volume, in the larger cities and their environs, that city lines today are little more than political divisions. Business and social movements pay little or no attention to them. Motorists often regard them as a division between good and bad traffic conditions. Sometimes the bad is outside, again it is inside the city. The desired end is the best possible conditions on both sides.

An interesting bulletin summarizing what has been done in the Buffalo-Tonawanda-Niagara Falls district has been issued by the Erie County Highway Department, Buffalo, N. Y. The matter in this article is reprinted from the bulletin.

The Situation at Buffalo.—Buffalo, because of the limited area of the city proper and the rapid industrial expansion to the north, east and south, and immediately surrounded by a number of thriving cities and towns, affords an unusual example of the need of regional planning. This unity was first expressed in concrete form when County Engineer George C. Diehl named it International City and tentatively included in its area 300 square miles in Canada, embracing the eastern tip of the Ontario peninsula and the Welland canal, and 400 square miles on the New York side of the Niagara river, eastern boundaries extending from five to ten miles from the river. The southern boundary was fixed about six miles south of Buffalo. Resources of this area, including unlimited hydro-electric power, cannot be discussed here but they include everything needful for a vast production of manufactured goods on the most favorable basis, a present population of a million people, and taxable assets of one billion five hundred million dollars!

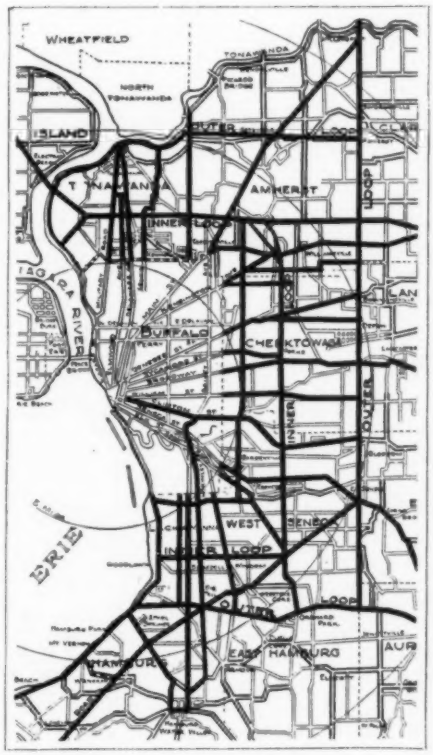


Fig. 1—Greater Motorways System of Erie County, New York

No political consolidation is contemplated, or possible. So far as commercial, economic and social life are concerned, the Buffalo-Tonawanda-Niagara Falls district is today a great center of activity, annually producing goods valued at more than a billion dollars. The new Peave bridge at Buffalo has brought us appreciably nearer to our Canadian neighbors, and those on the Niagara peninsula, through their business organizations, are cooperating to bring about the realization of a great industrial center on both sides of the international boundary.

Two principal governing bodies are concerned, the City Council of Buffalo and the Board of Supervisors of Erie County. Legislation has been enacted permitting them to cooperate for the creation of thoroughfares inside the city as they mutually may agree. Also, the State of New York extends its aid in the construction of State highways, bridges, etc., and the Federal government in a few instances.

Greater Motorways System.—In 1921 County Engineer George C. Diehl presented a comprehensive plan of highway improvement for Erie County, embracing all of the area outside of the city of Buffalo and connecting with main roads in the adjacent counties. It is known as the Greater Motorways System. Following approval by the State Highway Commissioner and the Board of Supervisors, it became the basis of all subsequent road improvement in the county.

This plan provides for the building, or widening, of 310 miles of highway to a paved width of 40 to 60 ft. It includes two loops extending from Lake Erie, south of Buffalo, around the city to the Niagara river on the north. The first, or inner loop, incloses an area of 85 square miles, or twice the area of Buffalo, and the outer loop an area of 170 square miles. These loops are crossed, or met, by 22 radial roads which are extensions of existing city streets. The plan further provides an alternative route, parallel with the Lake Shore road, for west traffic, connecting with the Lake Shore route at a point in Chautauqua County just south of the Erie County line and with both loops of the system, so that east, north and west bound through traffic can wholly avoid the congested downtown sections of Buffalo if they desire. It also provides for the widening of the more important roads from the city line to the county line. Approximately four million dollars are being expended on this system during the present season.

Notable developments along this line, establishing the fact that traffic conditions in the areas adjacent to the larger cities require highway facilities undreamed of a few years ago, include the regional plan for Greater New York, developments in the environs of Boston, the highway system of Wayne County, Mich., in which is located the city of Detroit, and many others.

Early Improvements Inadequate.—The older parts of all cities, with few exceptions, were laid out for horse-drawn vehicles. This was true also of highways in the territory adjacent to these cities. Until within comparatively recent years improvements, when they were made, were on the same inadequate basis. To widen the standard 66-ft. street in cities is very costly, sometimes impossible, and the usual compromise is a slightly widened pavement. In rural districts streets can be widened without damage to adjoining property and the Erie County Highway Department has consistently followed the policy of securing wider rights of

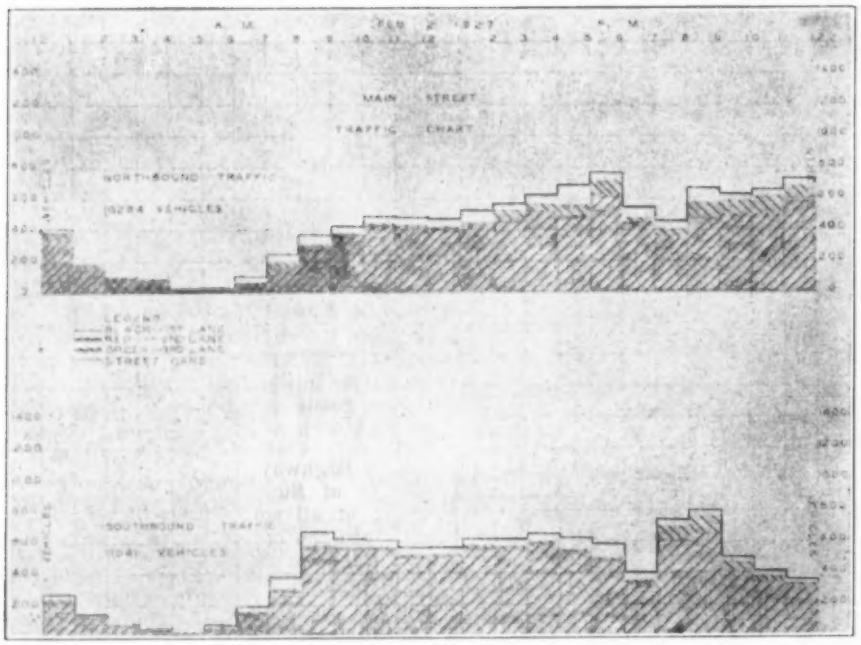


Fig. 2—Hourly Record of Main St., Buffalo Traffic. Watching From Left to Right Shows Traffic in Second Lane. Street Cars are Indicated by Black Outline. Practical Demonstration of the Fact that Main St. Affords Only One Lane of Travel in Each Direction. Shows a Lack of Segregation of Mass and Individual Traffic Which Is Detrimental to Both

way, both for existing highways and for those included in plans for future development.

Distances now are measured in time rather than miles. "Speed with Safety" has become the slogan of modern highway traffic. Loaded motor cars of one to five tons capacity and a gross weight of three to nine tons travel the highways at 20 to 40 miles an hour, and passenger cars at 30 to 50. These are factors which have changed living conditions, in town and country, and the planner who does not recognize them is living in a past traffic age.

Although road improvement was inaugurated in a few states prior to 1900 it is the past 25 years which produced the traffic problem. Providing adequate highways for the economical movement of traffic, the widening of existing streets and rights of way, the opening of new streets, are all results of conditions brought about by motor vehicles. The radius of zones requiring such improvements depends upon local factors. In many cases it is in excess of 50 miles.

Proceed Under Known Conditions.—All work projected by the Erie County Highway Department is on the basis of known factors, together with a careful study of probable future demand. A competent staff is constantly engaged in taking traffic counts, also noting the character and capacity of passing vehicles, and timing the whole movement. During 1927 such counts were taken on 18 radials entering Buffalo. (Four of the 22 radials are not yet opened into the city.) They were made outside of the city line.

The result is amazing. It shows 50,403,215 vehicle movements across the city line for the year, a daily average movement of 138,091 vehicles! These figures mean little to the average driver who simply knows that at certain intersections, and on certain streets, he is delayed because of traffic congestion, and that more stringent regulations are enforced to control his movements, and that various types of stop and go signals multiply faster than he can keep track of them.

Buffalo, located on the eastern shores of Lake Erie and the Niagara river, had no street or traffic way entering it directly from the west until 1927, when the Peace bridge was opened between the city and Fort Erie, Ontario. Prior to this a ferry was the only means of getting across the river with a vehicle without going to Niagara Falls. The highway system of the Province of Ontario was not improved to the extent of the systems in the states bordering on Lake Erie. For this, and other reasons, all traffic to or from the west, through Buffalo, has to cross the city's southerly line.

The Lake Shore road is the main artery for this immense volume of travel. Between this road and South Park avenue, a distance of two miles, there is no parallel road, most of the intervening space being occupied by railroad tracks and yards. On the whole south city line, a distance of three miles, there are only three thoroughfares entering the city—the Lake Shore road, South Park avenue, and the Abbott road.

Typical Widening Under Way.—The 16-ft. brick pavment on the Lake Shore road is being replaced, this year, by a 40-ft. concrete pavement, and otherwise improved as to grades, curves and bridges. As many as 25,000 vehicles have been counted on this road in a single day—a peak load far beyond its normal capacity. A somewhat devious route, obstructed by lift bridges in frequent use during the lake shipping season, and by railroad switches at grade, leads to the foot of Main street in Buffalo. This is an example of a situation in which the city planner and the regional planner have the same problem on the same route.

This situation, on the principal traffic artery to the west, is further complicated by mixed traffic and it is appar-

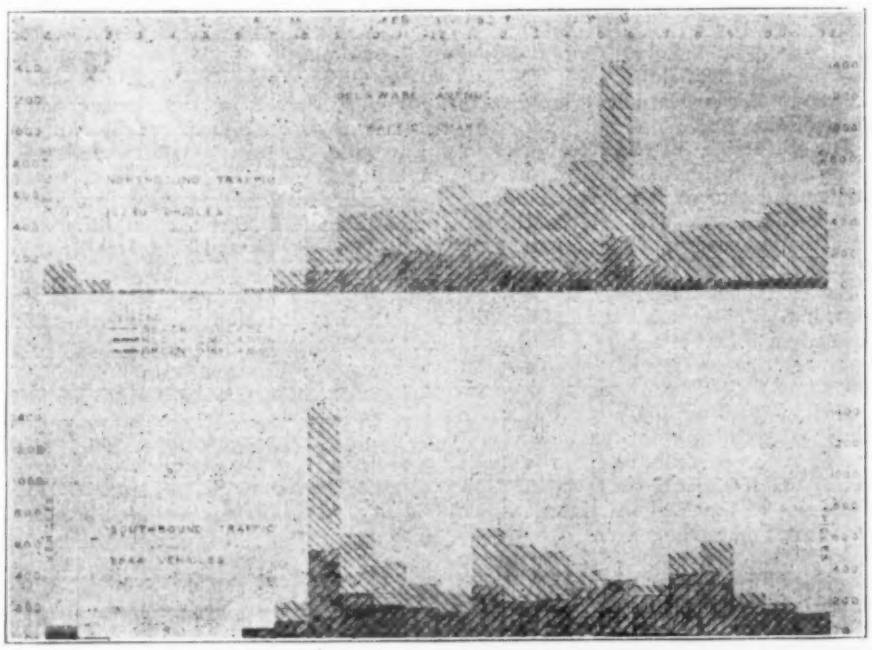


Fig. 3—Delaware Ave., Buffalo, With a Six-Lane Width, Shows Bulk of Traffic in the Third, or Inner Lane, in Each Direction, and Considerable Second Lane Traffic. The Narrow Black Line at the Bottom Shows How Completely Parking Prevents the Use of Lanes at the Curb for Traffic.

ent that within a short time the road's caapcity will be wholly taken up by deliveries to and from the great industries on the waterfront south of Buffalo. In this daily flow there are passenger automobiles, passenger busses, high-speed trucks, heavy-duty trucks, with an occasional horse-drawn vehicle for good measure. One horse-drawn vehicle, or one slow-speed heavy-duty truck, is more hindrance to traffic than many high-speed vehicles.

Study of Truck Movements.—Traffic counts, taken at two different points outside of the city line for the purpose of determining the percentage of trucks to the total traffic, show the following results for 1927:

Passenger cars	1,878,228
Light trucks	43,954
1-Ton trucks	58,473
2-Ton trucks	29,557
3½-Ton trucks	16,910
5-Ton trucks	19,267
7-Ton trucks	9,678
Omnibuses and motorcycles	20,928
Horse-drawn vehicles	9,774
Total vehicle movement at these two points	2,087,129

Of which 10 per cent was truck movement.

This percentage is slightly under the national average, which is computed at 12 per cent by the National Automobile Chamber of Commerce. This organization also estimates that 20 per cent of all trucks are on farms. From personal knowledge of trucks owned in rural communities it is fair to assume that practically all trucks of more than two-ton capacity, in the foregoing count, came from the city. Villages adjacent to the city contributed perhaps 20 per cent more to the total truck traffic. Thus it is seen that highway planning outside of the city is very directly concerned with city traffic and that city vehicle owners are immediately concerned with the class of highways outside the city limits.

This more definitely establishes the fact that the city planner cannot confine his ideas inside the limits of his municipality but must take into consideration the adjacent territory and thereby becomes a regional planner. Likewise, the one who is planning adjacent to the city cannot ignore its street arrangement. The work of the two overlaps and they must work in harmony if proper results are to be obtained.

Designing Highway System.—In designing a highway system the work can be divided into two major portions:

First, the general design or layout, taking into consideration the points of origin and destination of the traffic, the localities which should be served and those to be avoided; and

Second, the amount and character of existing traffic and the increase which can be reasonably expected.

In the more developed sections the ability to detour much of the traffic around a central, or congested, district is fully as essential as it is to bring traffic to such points. Concentration creates values but congestion ultimately reduces them. The purpose of the loops and by-pass roads of the Greater Motorways System is to secure a distribution of traffic so that any driver may reach his destination in the least time, avoiding congested sections in which he has no errand or reason to visit.

In determining pavement widths, parked vehicles and slow-moving vehicles must be taken into account. As traffic increases to thousands of vehicles a day upon any one highway it becomes practically impossible to secure speed with safety without at least three lanes of traffic, or, one lane for stationary (parked) vehicles, one lane for slow-moving vehicles, and one lane for fast-moving vehicles, in each direction. While rural districts are not wholly free from parking it is only in special cases that it need be provided for in the construction of highways. In this state 10 ft. is now the accepted width for a traffic lane.

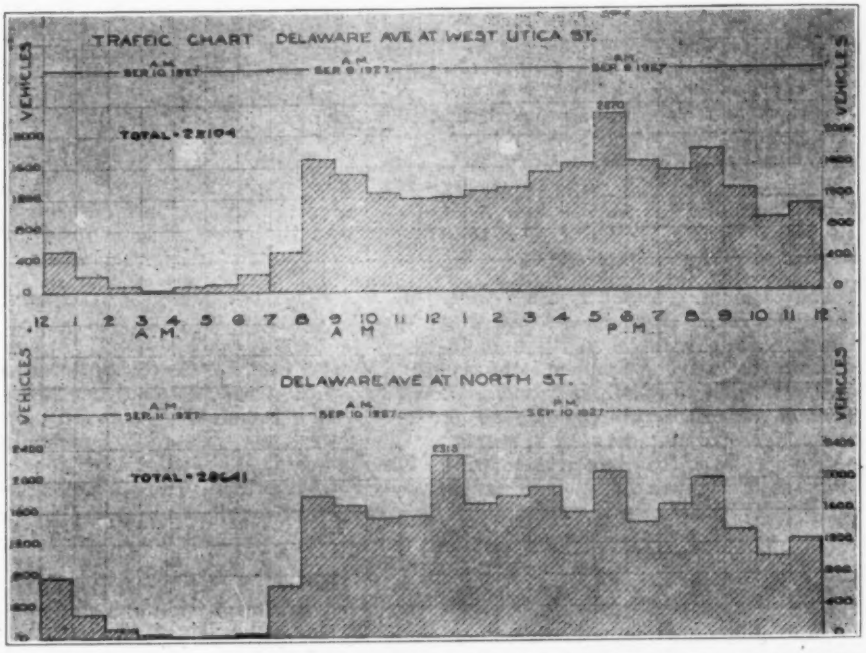


Fig. 4—Delaware Ave., Buffalo, Traffic Records at West Utica and North Sts. Because These Counts Were Taken After the End of the Tourist Season They Show the Every-Day Business Use of This Street and Demonstrate a Remarkable Uniformity in the Volume of Traffic

Records of automobile traffic, both local and general, for several years past, show an average increase in vehicle movements of approximately 10 per cent a year. This percentage may decrease slightly in coming years as we more nearly reach the so-called point of automobile saturation. Assuming that such decrease would compensate for the increase due to compounding the normal increase of 10 per cent we would have, in Erie County, 75 million vehicles crossing the city line five years hence. These are large figures, but who, in the face of the traffic history of the past 10 or 15 years, can say that they are absurd?

Formulae Sometimes Misleading.—Several formulae and diagrams have been established which purport to show the number of vehicles that can be carried over a two-lane road, that is a road having one lane for travel in each direction, in a given space of time. All such equations and graphs, however, are based upon uniform vehicle movements, a practical impossibility, and do not take any account of the personal factor. If we can imagine a line of motor vehicles, rigidly fastened to each other, and moved along the highway by a piece of machinery, such a line might approach the theoretical capacity of the road. One slowly moving truck, or an automobile whose occupants are more interested in scenery than they are in reaching their destination, will retard the movement of the whole line. Speed must be based upon actual operating conditions, and the usual graph must be divided by two or three to get the actual capacity of the road.

Still another reason why the theoretical volume of traffic cannot be safely and speedily carried on a highway is the constant change, from hour to hour, in the number of cars using the highway. In many instances, with a high peak load during certain hours, traffic frequently reaches the vanishing point in the early hours of the morning. Therefore, we are compelled to design with the maximum real traffic in view, and not the average real traffic.

Trucking and trolley corporations often are blamed for obstructing traffic, but both services are essential to carrying on the city's daily business and must be given due consideration in any reasonable study of the traffic problem. All of which brings us back to the original premise that our streets

were designed for a kind and quantity of traffic comparatively insignificant.

Graphs of Buffalo Traffic.—The graphs reproduced in this bulletin serve to illustrate the hourly, daily, and seasonal fluctuations, as well as other details of this city's traffic. They are based upon actual counts taken by the Erie County Highway Department on the streets indicated. In them you will find presented the peak hours and the practical disappearance of traffic in early morning. Black lines at the bottom of the graphs show two lanes of traffic, next to curbs, practically monopolized by parked cars, and of little value to movement. The graphs also illustrate the slowing of traffic because of street car tracks, to be noted in the comparison of travel on Delaware avenue, without car tracks, and on Main street, with a double line of tracks. Both streets are the same width. They also show clearly the value of a third traffic lane, for rapid movement.

The value of good roads is no longer debated. Aside from the service they render they pay for themselves in increased values. The problem is to provide sufficient road surface to meet the demand. The proper expenditure of money for road and street improvement is of direct benefit, and an actual saving of money, as well as an increase in comfort and safety.

Truck Speeds on English Highways

The British Minister of Transport has issued an order revising the speed limits at which motor vehicles exceeding two tons in weight unladen, may be driven on public roads. The order, which went into force on Oct. 1, in general, will raise the limits for vehicles fitted with pneumatic tires or with tires which, though not pneumatic, are of soft or resilient material. Heavy motor vehicles without trailers, if they are fitted with pneumatic tires, are permitted to travel at 20 m.p.h. instead of at the former maximum of 12 m.p.h., and those fitted with solid rubber tires or with partly solid and partly pneumatic tires at 12 m.p.h. In the case of heavy motor vehicles with trailers attached, both the vehicle and the trailer being fitted with pneumatic tires, the speed limit is 12 m.p.h. in place of the former 5 m.p.h. If the vehicle and its trailer are fitted with solid rubber tires or partly with solid and partly with pneumatic tires, the new speed limit is 8 m.p.h. The order also provides for the compulsory fitting of reflecting driving mirrors to all heavy motor vehicles except those carrying a conductor or other person at the rear who can communicate the effect of signals received from other vehicles behind his own to his driver.

Highway Confederation to Study Route for Pan American Road

Officials of the Pan-American Confederation for Highway Education have addressed letters to the ministers of the Central American republics and Panama asking if their several countries desire the cooperation of the Confederation in a reconnaissance survey of a route for the proposed Pan-American highway connecting the nations of North, Central and South America, according to an announcement by Dr. L. S. Rowe, Director General of the Pan-American Union.

This action by the Confederation follows a resolution passed by the governing board of the Pan-American Union requesting the highway organization to undertake the compilation of data and the preparation of projects looking toward the realization of the age-old dream of a longitudinal highway linking the peoples of the Americas.

By resolution of the Sixth International Conference of American States, meeting at Havana last January, the Union was entrusted with this study, its findings to be submitted to the Second Pan-American Congress of Highways to meet at Rio de Janeiro in June, 1929. The Union, by its subsequent resolution, transferred the project to the Confederation, "as peculiarly equipped to undertake the task," subject to the approval of the executive committee of the Confederation. A ballot by telegraph was taken by Pyke Johnson, executive director of the Confederation, and Dr. Rowe today was informed of the unanimous approval of the executive committee.

If favorable replies are received from the several countries, the Confederation will begin an immediate field reconnaissance, ultimately submitting its conclusions to the governing board of the Union, which, in turn, will make its recommendations to the Second Pan-American Highway Congress.

On the basis of official information already available, the Confederation has made a preliminary study of the project, going so far as to draft a map showing the tentative routes of the proposed Inter-American Highway through the United States, Mexico, Guatemala, Salvador, Honduras, Nicaragua, Costa Rica and Panama. These data are based on existing highways, and it is believed that the limited information on hand may have failed to disclose the most feasible routes and connecting links in a chain of highways which ultimately is to comprise the great Inter-American Highway.

Because of the limited time before the Second Pan-American Congress of Highways will convene at Rio de Janeiro in June, 1929, the activities of the Confederation will for the present be limited to studying the most feasible route for an Inter-American highway through Central America and Panama. Later it is intended to extend these studies to the South American countries. The government of Mexico, it is stated, has already formulated a comprehensive highway program. This program includes a road from the northern border of Nuevo Laredo to the border of Guatemala, which, it is stated by Dr. Octavio Dubois, chairman of the National Highway Commission of Mexico, will be completed within the next two years, and will form the Mexican link in the proposed Pan-American highway.

Recognizing the need for immediate action, Dr. Rowe, in his letter to the ministers, inquires first if their respective governments have made preliminary studies of the route, requesting such information if it is available. If not available, he asks if their governments desire the cooperation of the Confederation in making reconnaissance surveys.

Dr. Rowe occupies the dual position of director general of the Union and chairman of the executive committee of the Confederation. Other members include Wilbur J. Carr, Assistant Secretary of State of the United States; Roy D. Chapin, former president of the National Automobile Chamber of Commerce; J. Walter Drake, former Assistant Secretary of the Department of Commerce; Thomas H. MacDonald, Chief of the United States Bureau of Public Roads; Fred I. Kent, representing the American Bankers' Association; W. O. Rutherford, representing the Rubber Association of America; Pyke Johnson, executive director; and Stephen James, director of extension. Mr. Drake was appointed as the personal representative of President-Elect Hoover while he was Secretary of Commerce.

Thus are taken the first practical steps looking toward the ultimate achievement of a project that has fired the imagination of leaders of every country on the American continent. President Coolidge is known to favor the highway in principle. It has been the subject of repeated resolutions, informal conferences, addresses and magazine and newspaper articles since highway transportation first became a reality.

The Confederation was organized tentatively in 1924 by a group of Latin engineers, achieving its permanent character at the first Pan-American Congress of Highways at Buenos Aires in 1925. By request of its organizers, headquarters are maintained in Washington, with branches, generally known as highway education boards, in most of the principal countries of the Pan-American Union.

Unbalanced and Unresponsive Bids

The Meaning of the Two Kinds of Bids

By EDGAR SHOOK
Attorney, Missouri State Highway Commission

THE term "unbalanced bid" is anciently familiar to engineers and contractors. The term "unresponsive bid" has, so far as I know, never been used in defining the vice of a bid in response to an invitation to submit bids for the doing of public work. It is my purpose in this article to lend some assistance to the contractors who are engaged in doing public work in understanding the vice of unbalanced and unresponsive bids. I do not propose to write a scientific, legal exposition of these terms, but rather to set out in as plain and simple language as possible the meaning of these terms and the detriment of unbalanced and unresponsive bids.

The Lowest Responsible Bidder.—Practically all public work is required by law to be let to the "lowest responsible bidder" or to the lowest and best bidder, or to the party fulfilling the description of language of similar meaning. It is in ascertaining who is the lowest responsible bidder that the question of unbalanced or an unresponsive bid becomes material. It has been determined in practically all states that the lowest responsible bidder does not mean the bidder, the aggregate of whose unit prices bid multiplied by the estimated quantities in the estimate of the engineer is the lowest in terms of dollars and cents, but the public body is authorized in determining the lowest responsible bidder to take into account other items such as the bidder's skill and experience. It is, however, the policy of the law of all states and municipalities to seek to have contracts for the doing of public work awarded to a responsible party and after a responsible party has been found to award the contract to the lowest bidder. In ascertaining who is the lowest bidder the question of an unbalanced bid becomes important. The question of an unresponsive bid is also important.

The Unresponsive Bid.—A very popular means of determining the lowest bidder is found in the system where the engineer or other representative of the public body makes an estimate of the several quantities of work to be performed and then invites the contractors to submit bids upon the assumption that the quantities estimated by the engineer are correct. This method of determining who is the lowest bidder necessitates the assumption by each bidder of the correctness of the quantities estimated by the engineer. While it is true that practically all such estimates and the invitation of the public body for bidders advise the bidder that the estimate is approximate only, it will be found upon reflection to be impossible to determine the lowest bidder unless each bidder has assumed the quantities estimated by the engineer. In other words, there must be a certain basis of comparison, and under this scheme of bidding it is found in the estimate of the engineer. Each bidder must assume as correct the quantities estimated by the engineer. Therefore, a bid which has not assumed the quantities estimated by the bidder is an unresponsive bid. That is, it is a bid which is not responsive to the invitation, or to state it another way, it is a bid founded upon an assumption other than that made by the engineer. The vice of an unresponsive bid will be considered further in this article, but let it be borne in mind that an unresponsive bid is one thing, while an unbalanced bid is another thing.

Discovering the Lowest Bidder.—Public contracts are quite generally let today upon estimates of the several classes of work to be performed, the public body classifying the several items of work to be done. This system of letting public contracts has largely replaced the old lump sum contract whereby an agreement was made to do a quantity of public work for a lump sum without regard to the cost of the several items to be done. Experience has shown that the public body will more probably be able to secure the doing of public work at a just and fair price when it has advised the bidders of the several classes and quantities of work to be done and ask that in submitting a bid for doing the work the bidder itemize the price at which he will do the several classes of work. Of course, it is well understood that the bid received by the public body and accepted under the present scheme does not constitute a contract to do the work for the total of the lowest bid. The contract provides that the contractor shall be paid the amount of money which shall be determined by multiplying the actual quantities of work performed by the unit prices contained in his bid. Every contractor knows that the amount which he actually receives for the performance of a public contract let under this scheme may fall materially below or may considerably excel the total amount of his bid. So then it is quite clear that the purpose of the bid is not to determine the amount which will be ultimately paid to the contractor, but only to discover who is the lowest bidder.

Fixed Standard Necessary.—As intimated earlier in this article, it is necessary to have some fixed standard in order to determine who is the lowest bidder in a system whereby the lowest bidder is determined by multiplying the various estimated quantities by the unit price bid by each of the several bidders. In other words, it is necessary for each bidder to make the same assumption, i. e., adopt the same hypothesis in order for a comparison of prices to be made. If the engineer has estimated the quantities of work to be done, and if there are ten bidders who submit bids for doing the work and each of the bidders assumes quantities other than those estimated by the engineer, then there is no intelligent basis of determining who is the lowest bidder. It is unnecessary to argue that the unit price at which work can be done varies in part according to the quantity of work to be done, and therefore, a bidder who believes the estimate of the engineer to be incorrect and who, believing this, submits a bid based upon the quantities which he estimates rather than upon quantities estimated by the engineer, is, in fact, proposing to do an entirely different thing from a bidder who assumes the quantities estimated by the engineer and submits his bid accordingly. It may be true that the bidder who has looked over the project and estimated that instead of 10,000 cu. yd. of earth excavation that there is in fact but 1,000 yd. of earth and 9,000 additional cubic yards of solid rock, has more nearly estimated the quantities which will actually be developed in the doing of the work, yet his bid cannot be compared with that of the bidder who has assumed the quantities estimated by the engineer because the bidder who has set up his own judgment is, in fact, proposing to do something entirely different from that proposed to be done by his rival bidder. A bid which assumes quantities other than those assumed by the engineer is an unresponsive bid. That is, it is a bid which varies the assumption which he was invited to make. The vice of an unresponsive bid is not that the bidder may have erred in estimating the amount of work to be done, but the fact that he has not given to the public body a bid based upon the assumption which he was asked to make, and therefore, his bid cannot in fairness be considered at all because it has destroyed the basis of comparison by means of which the

lowest bidder is to be ascertained. Under the scheme of awarding contracts on the basis of bids submitted upon the estimate of the engineer, the contractor can only assume the quantities estimated by the engineer, if there is to be any proper and fair comparison, for the purpose of determining the lowest bidder.

Since practically all public bodies supply contractors with proposal forms in which the quantities estimated by the engineer are set out, the bidder cannot change those quantities, and hence the public body, in discovering whether or not his bid is responsive to the proposal, is generally required to examine the prices submitted by the bidder. Suppose, for example, that a public body asks bidders to submit bids upon three classifications of excavation, earth, loose rock and solid rock. If a bidder purposes to do earth excavation at a ridiculously low figure and has abnormally increased the price at which he proposes to excavate loose or solid rock, the public body is warranted in saying whether or not there is such a disparity between the prices bid and the normal cost of doing the respective classifications of work that the bidder has in fact assumed quantities other than those estimated by the engineer. If there be reasonable ground for believing that the bidder has made an assumption different from that of the engineer's estimate, then the public body is warranted in discarding the bid without further consideration, notwithstanding the fact that it may be on its face the lowest bid. The reason for this is, as above pointed out, that there is no means of determining who is the lowest bidder unless all parties adopt the same hypothesis, that is, assume the same quantities, and since the bidder is not contracting to do the work for the aggregate, he may, by having changed the assumption of the engineer, wrongfully profit at the expense of the state. It is not in my opinion a question of whether or not the engineer's estimate is correct, but it is a question of whether or not each bidder has assumed the engineer's estimate of quantities. If this has not been done in any case, then the bid is not responsive and cannot be compared with bids which have assumed the quantities estimated by the engineer. Perhaps it will be said that this scheme of bidding leaves nothing for the contractor to determine. It certainly does not leave open to his determination the quantities upon which he will base his estimate. He will want to know the circumstances of the work which is to be done, its location and accessibility, and the means of transporting materials of construction, the availability and cost of labor, and numerous other items. Under this scheme of bidding the contractor must assume the quantities estimated by the engineer.

Why Items Are Classified.—The purpose of classifying various items of public work to be done is to secure an intelligent and just price. When a public authority has classified various items of work to be done on the theory that the several classes of work involve more or less expense, that fact must be taken into account by bids upon public contracts. In other words, there must be a recognition in the bid of the fact that various classes of excavation will vary in price. It is not possible to define the ratio that should exist between the cost of excavating earth and the cost of excavating loose rock, or between the cost of excavating loose rock and the cost of excavating solid rock, but a bid which proposes to excavate loose and solid rock at the same price at which it proposes to excavate earth is a bid which has on its face failed to take into account the classifications set up by the public authority. Such a bid is in fact an unbalanced bid. It is probable that an unbalanced bid is after all only an unresponsive bid. In the case of People ex rel. Williams vs. McDonough, Secretary of State et al., 83 N. Y. Supplement, page 125 (local citation), page 127, Judge Chase quotes from the Century Dictionary the following definition of an unbalanced bid: "A bid for the performance of a given work at specified rates for each of the various kinds of labor or material required, which, by being made on an erroneous estimate of quantities of each, appear, assuming these quantities to be correct, to be low in comparison with other bids, when a computation based upon true quantities would make the bid high." There is in a bid in which the bidder proposes to do three classifications of excavation for the same price, a strong suggestion that the bidder believes the quantity of loose rock and solid rock which will actually develop on the job to be comparatively small, for uniform experience will reveal that the bidder could not excavate loose rock and solid rock at the same unit price as that at which he could excavate earth. What he has done then is to change the quantities estimated by the engineer. He has said that there is not the loose rock and the solid rock estimated by the engineer, but that it will all be earth, and in such a case this public authority will probably find itself confronted with a high bid for excavating earth. This same result is sometimes accomplished by increasing the price of earth and slightly diminishing the price of loose rock and materially diminishing the price of solid rock. But in many instances in which the bidder in his proposal offers to do the various classifications of excavation estimated by the engineer for the same price he submits an unbalanced bid. In this sense "unbalanced" means a bid which does not recognize the difference in value and cost of doing the several classes of excavation, or other work, which the public authority has said constitute different classes, and therefore, have classified such work and ask that bids be submitted upon the classes to be established by the public authority. After all, however, the vice of an unbalanced bid is undoubtedly the vice of an unresponsive bid, namely, that an unbalanced bid has made an assumption different from that upon which bids are invited and, therefore, for the purpose of determining who is the lowest bidder, such an unbalanced bid is not entitled to consideration.

Acknowledgment.—We are indebted to The Construction Advisor for the above article.

Contracts Let for Three New Toll Bridges

Announcement of the award of contracts for construction work on three bridges to be operated by the National Toll Bridge Co. has been made by J. G. White & Company, bankers for the company. The contracts that have been let are those for the sub-structures of the Hermann Bridge over the Missouri River at Hermann, Mo., the Madison Bridge over the Ohio River between Madison, Ind., and Milton, Ky., and the Independence Bridge to be erected across the Missouri River near Kansas City.

The Hermann Bridge contract was awarded to the Foundation Co. of New York. The Madison Bridge substructure will be built by the Vang Construction Co. of Pittsburgh. The contract for the Independence Bridge sub-structure has been let to the Union Bridge & Construction Co. of Kansas City.

The sub-structure of the Hermann Bridge is to be completed April 15, 1929; and the completion of the entire bridge is expected by Sept. 15 of next year. The Independence Bridge substructure is to be completed by May 15, and the present schedule calls for completion of the entire bridge by October, 1929. The sub-structure of the Madison Bridge is to be ready by July 15 of next year with completion of the entire structure set for Jan. 1, 1930. Plans for all three bridges have already been approved by the Acting Secretary of War.

Gasoline Tax in New Hampshire Nets $1,495,741 for Year.—The state treasurer has announced that gasoline tax collections by the state during the last fiscal year, ending June 30, totaled $1,528,778, and that after refunds amounting to $33,037 and the expense of collection, $318 was deducted, the net return to the state treasury was $1,495,741. The tax was 3 ct. up to Jan. 1, thereafter 4 ct. This compares with net receipts of $770,358 in the preceding fiscal year, when the tax was 2 ct. for 10 months and 3 ct. for two months.

Some Traffic Considerations Controlling Selection of Bridge Types

Traffic Service Ultimate Purpose of Bridge Structures

AFTER the preliminary surveys have been completed for any bridge structure and before any work can be done on the detailed design or preparation of plans, it becomes necessary to make at least a tentative selection of the type of construction best suited to the particular needs involved.

It is this particular phase of the work, indeed, which Mr. C. B. McCullough, bridge engineer for the Oregon Highway Commission, discusses in his book entitled, "Economics of Highway Bridge Types." In the introduction to this book, which will soon be off press for publication by the Gillette Publishing Company, 221 E. 20th St., Chicago, he says, "Particular attention is directed to the fact that the discussion has been prepared for the highway engineer in general rather than the highway bridge engineer, carefully avoiding lengthy technical or highly specialized subject matter throughout, and the attempt has been made to make the (numerous) cost curves and quantity data sheets sufficiently general in application to cover the average practice." The following article was constructed from material out of this manuscript.

The question of economy in first cost, maintenance and renewals is naturally a major controlling consideration and one which in order of importance should, possibly, receive first mention. The economics of any bridge problem, however, are generally investigated after certain other controlling conditions have received due consideration. There are, of course, many considerations which operate to dictate the selection of type for any particular highway bridge. The major controlling factors, however, may be conveniently grouped for discussion as follows:

A. Stream behavior.
B. Requirements of navigation.
C. Traffic considerations.
D. Architectural features and scenic considerations.
E. Condition of available funds.

This article discusses traffic considerations as one of the controlling conditions, which operates to determine type selection.

Chief among considerations of this character may be mentioned the following:

Sight Distance.—It is sometimes necessary that a bridge be placed on a sharp curve. In such case unobstructed view, as shown in Figure 1, should be employed. Figure 2 illustrates the sight restriction due to the employment of housed timber truss construction on an alignment having sharp curvature approaching the span. Through steel truss construction is open to this same objection, but naturally, to a very much less extent. With present day traffic concentration, highway bridges should be designed with the greatest possible regard to clear and unobstructed vision.

Traffic Movement.—Traffic service is the ultimate purpose of any bridge structure. In the question of type selection, therefore, thorough consideration should be given to such questions as (a) the direction of traffic movement over the span, (b) provision for the separation of fast and slow moving traffic, (c) distribution and collection of traffic with minimum congestion at the bridge head, etc. Traffic roadways should be designed to accommodate the maximum existing and probable future traffic needs, and where traffic density is great ample roadway width must be provided. Where the traffic demand necessitates a wide roadway a condition such as is illustrated in Figure 3 may be found to exist. Type A employs a two truss design, but the floor system becomes so heavy as to prove uneconomical. Type B is much cheaper in first cost, but involves a separation of traffic lanes. This condition is not particularly objectionable, if traffic density in both directions is balanced at all times. In the majority of cases, however, this balance does not exist. If, for example, eastward traffic is heavy in the morning and westward traffic heavy in the evening, an unobstructed roadway will permit three lines of traffic eastward to one westward in the morning. In the evening conditions will automatically reverse themselves, thus affording the necessary flexibility in capacity. If a truss is placed in the center of the roadway, however, traffic in either direction is limited to a two lane way, regardless of the relative densities. An arrangement designated as Type C (Figure 3) is sometimes employed. Such an arrangement leads to serious complications, especially in connection with street car or interurban traffic as will be seen by a study of Figure 4. If the arrangement (shown at 4a) is employed wherein street car tracks run straight through between the trusses, slow moving traffic (horse drawn) must be placed outside the trusses, as otherwise such traffic will seriously obstruct street car movement within the span. Such slow moving traffic has the effect of forcing all other traffic to the center of the bridge on account of the absence of adequate passing space outside the truss. This practically reduces the effective capacity of the structure to a two lane roadway, as far as motor traffic is concerned. If on the other hand, the arrangement shown in Figure 4b is employed, fast traffic can occupy any portion of the roadway, as there is adequate passing space inside the truss. However, this arrangement introduces four crossing points between vehicular and street car traffic lines (two at each end of the bridge, as shown at the points designated "A" in Figure 4). This condition is obviously highly objectionable, especially in wet weather.

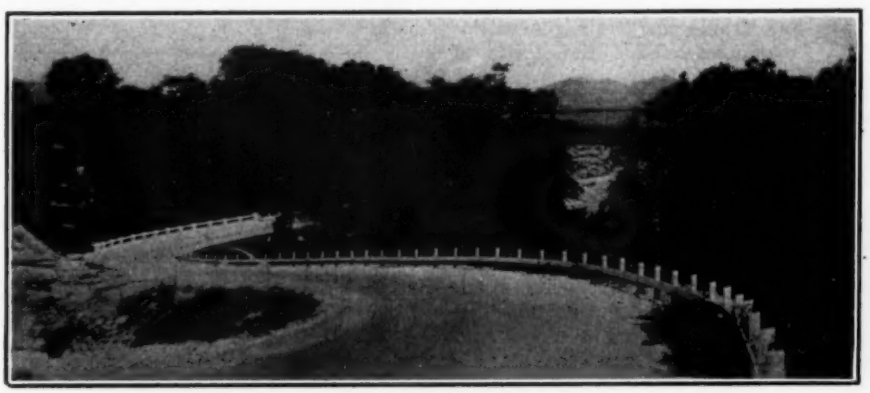


Fig. 1.—Good Treatment for Sight Distance on Sharp Curved Approach

The deck truss (Type D, Figure 3) eliminates every objection above listed and from a traffic standpoint is much superior to any other type. It may be that clearance requirements eliminate this type from consideration on the proposed grade line in which case it becomes necessary to investigate the feasibility and cost of a new grade line

modified so as to permit deck construction and also the feasibility of a special shallow truss design. In the final analysis when the relative economy of the different types is determined, the unobstructed roadway should be given a great deal of preference and should be chosen unless cost considerations are prohibitive or other reasons make its use impracticable.

Traffic Collection and Distribution.—By virtue of its position, a bridge structure, especially when located in or adjacent to a municipality, is a point of traffic constriction, the "neck of the bottle," as it were, and in type selection as well as in location some consideration must be given to the provision of adequate collection and distribution facilities. Such facilities may in general be divided up into two main subdivisions:

(a) Traffic plazas (in general located outside the limits of the structure itself).

(b) Ramps or bilateral approaches constructed as part of the bridge structure.

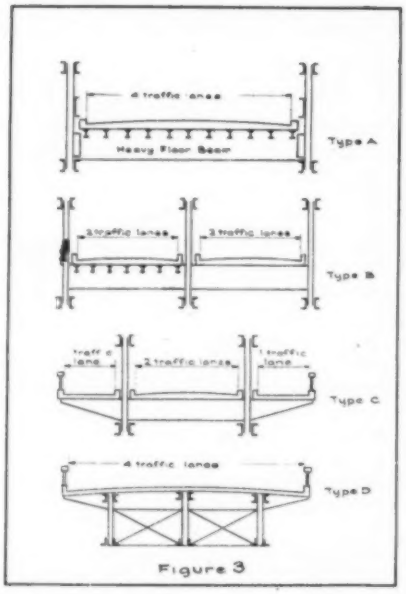


Figure 3

A typical traffic plaza suitable for a two lane traffic way is illustrated in Figure 5. It will be observed that all vehicular traffic intersections are eliminated, all traffic being picked up on the circle, rotated to its outlet and distributed, traffic along the circle thus moving in one direction only. It will be noted however, that the pedestrian crossings involve an intersection with vehicular traffic lines. This condition can be eliminated by adopting a system of pedestrian subways, as described later on. Figure 6 illustrates a traffic plaza arrangement suitable for heavier traffic densities. In this arrangement all traffic is delivered to a distribution circle containing two or more traffic lanes. All traffic delivery is made on the outside lane and works its way to the inner lanes through a system of "cross over" paths, the inner paths being used only in times of heavy traffic flow. From the plaza circle traffic delivery to the various outlets is also made from the outer lane of the circle, traffic working its way to this outer circle before reaching its point of delivery by means of a system of oppositely directioned "cross overs" as shown in the figure. It is possible for traffic lines to cross in this arrangement, but ordinarily the traffic will swing to the outer circle in sufficient time to avoid any direct intersection of lines. The pedestrian traffic may be taken care of at grade or by means of foot traffic subways, as shown in Figure 6. Under the bridge proper it is generally a comparatively easy matter to arrange for a pedestrian footway. Under the graded streets the cost of a pedestrian subway is greater, but by no means prohibitive. Where pedestrian traffic crosses the streets at grade, an arrangement known as "traffic parking storage" may be made, as shown at point "A" in Figure 6. Here traffic heading north or west will continue around the circle, while traffic headed east, when stopped by the pedestrian traffic north or south along the street crossing, may pull into the "traffic storage" space at "A" (thus being out of the way of the through traffic) and wait until pedestrian traffic has cleared. If the bridge head is so located as to create a demand for parking facilities for autos, the same may be provided at the entrance, as shown at point "B." The center plaza or circle may also be converted into parking space, if necessary, although this can hardly be regarded as a desirable arrangement. In general traffic plazas are designed with some architectural significance and the core of the circle parked or marked with a suitable monument. Figure 6 illustrates four different corner treatments which are typical traffic plaza arrangements of this character. In the case of memorial bridges, a rather dignified and pleasing effect may be secured through the adoption of a monumental entrance treatment. In the style of treatment shown at "B" the sidewalk passes through an archway in the entrance monument, at point "C" is indicated an arrangement wherein the sidewalk passes in front of the entrance structure. The type of traffic plaza and entrance treatment to be adopted in any case is dependent upon many local factors and the general discussion need be carried no further at this point. In any case, however, the arrangement employed should be based upon a study of the general trend of traffic flow, the maximum flow being given the maximum channel.

"Ramps" or "bilateral approaches" are traffic outlets or intakes placed upon the structure itself or constructed as a component part of the same. From Figure 7, which indicates a typical double ramp arrangement, it will be observed that the number of traffic line intersections is not reduced through the employment of the ramps or bilaterals. The rapidity of traffic movement to and from the bridge is, however, greatly increased. When traffic is open on Water Street, all north bound traffic on the bridge would be held up were it not for ramp "A" which permits the above traffic to move off the span, thus re-

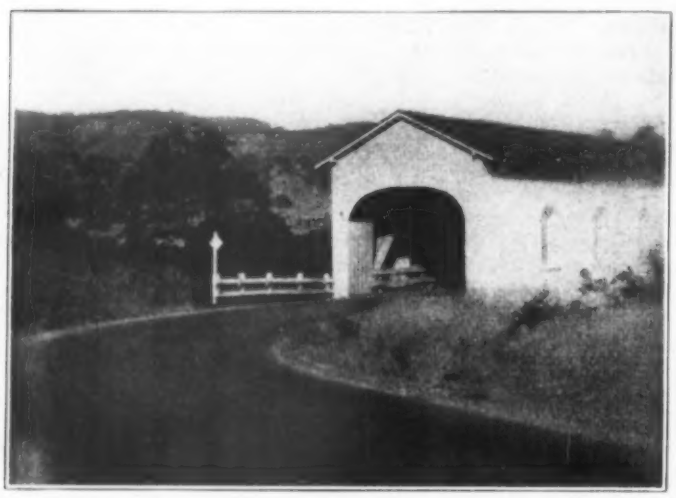


Fig. 2.—Restricted Sight Distance for Covered Span on Sharp Curved Approach

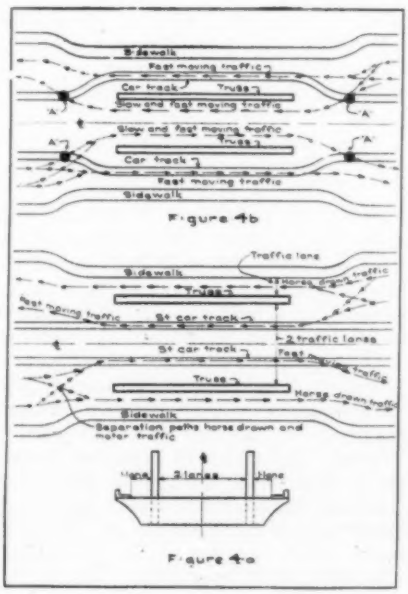


Figure 4b

Figure 4c

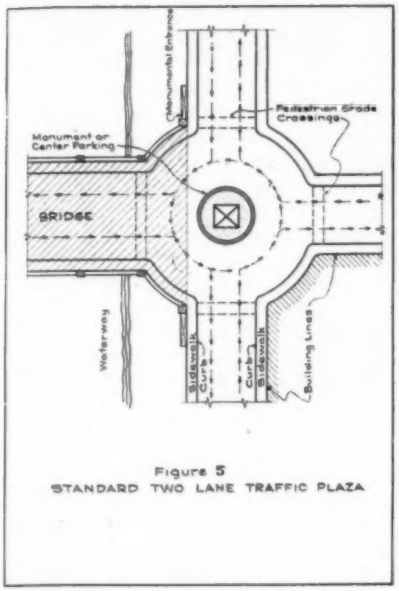


Figure 5
STANDARD TWO LANE TRAFFIC PLAZA

lieving the bridge congestion. During this same period ramp "B" permits east bound traffic on Water Street to head into the bridge, thus helping to clear Water Street more quickly than otherwise.

Traffic to and from Waterfronts.—Where the highway bridge crossing is within the corporate limits of a city or town, it frequently happens that the bridge structure must be designed with due regard to the provision for traffic to and away from the water front, and also for traffic from the business places facing the bridge structure on either side of the street, as shown in Figure 8. Questions of such character may modify the type selection, both as regards span lengths for approach construction, roadway widths on approaches, and location of grade line. For navigable stream crossings such considerations may also effect the choice between high level vs. movable span construction. In view of the above, therefore, a general discussion of some of the major traffic problems involved, together with a few typical solutions, may be of value at this point.

Consider for example, the general layout shown in Figure 8. The street marked "First Street" is a heavy hauling traffic way along the river front and contains a double track street railway line. The street upon which the bridge structure is located is occupied by shops and wholesale stores. Alley "C" is rather active from a traffic standpoint and must be kept open. The traffic problem resolves itself into the following:

(a) Provision for a grade separation at point "A."

This is extremely important, otherwise there arises a condition wherein through traffic moving at a comparatively high speed is intersected with slow heavy hauling traffic, moreover a certain portion of this heavy traffic may turn eastward across the bridge, which would operate to congest traffic at the bridge head were the grade line lowered to intersect point "A" at the grade of First Street. In addition to the foregoing, considerations of traffic safety demand a separation of grades at all intersections of highway and railway traffic wherever possible. In this case, the railway traffic is city electric service, but even in this case the element of danger is only lessened and not by any means eliminated.

(b) Provision for traffic from points on First Street eastward across the bridge.

With the high grade line necessary for a grade separation at point "A," any traffic originating on First Street and having a destination eastward across the bridge will be compelled to travel a very devious and lengthy path and to make a sharp turn at point "B"

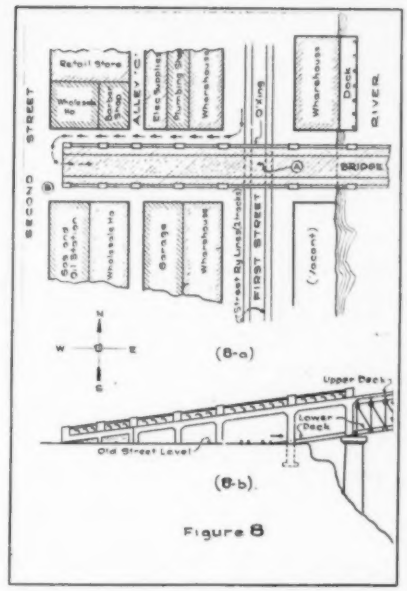


Figure 8

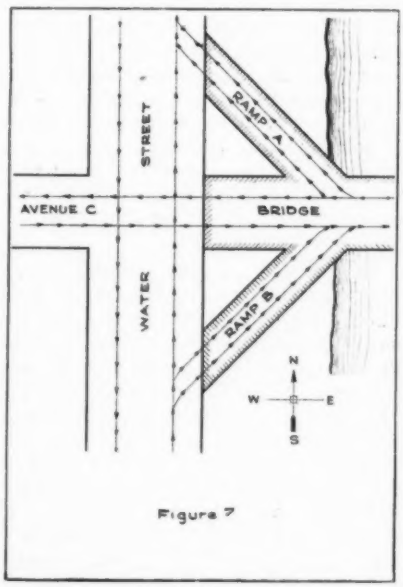


Figure 7

to get onto the bridge, as shown by the arrow path (Figure 8a). This is objectionable from the standpoint of local traffic itself and even more so from the standpoint of through traffic, as it introduces the very element of congestion at the bridge head that the grade separation has sought to eliminate.

Among remedies which suggest themselves in this case are the following:

(1) A double deck design routing the heavy traffic directly onto the lower deck. The feasibility of this procedure would, of course, depend upon the limiting vertical clearance requirements for the river spans. If this were to be done, all heavy hauling should be routed so as to reach the lower deck, thus leaving the upper deck free for fast moving traffic only. A traffic routing of this kind might necessitate a wider roadway along the side of the bridge approach between First and

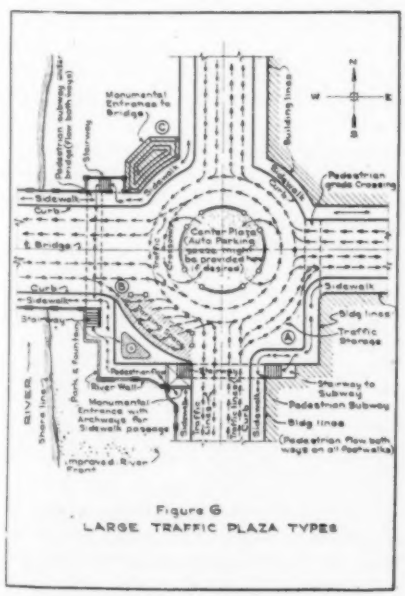


Figure 6
LARGE TRAFFIC PLAZA TYPES

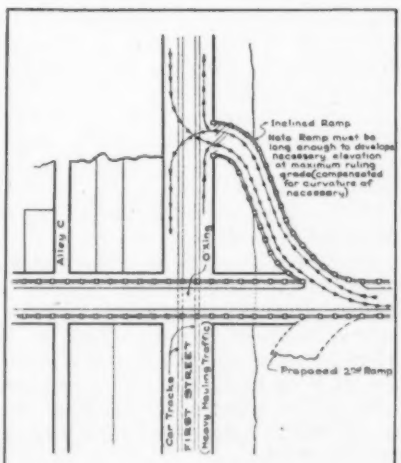

Inclined Ramp
Note Ramp must be long enough to develope necessary elevation at maximum ruling grade (compensated for curvature of necessary)
Alley C
O'Ring
Car Tracks
FIRST STREET
(Heavy Hauling Traffic)
Proposed 2nd Ramp

Figure 9
TYPICAL DOUBLE TRACK RAMP OR BY-LATERAL CONNECTION FOR PURPOSE OF CONNECTING FIRST ST WITH THE BRIDGE DECK LEVEL

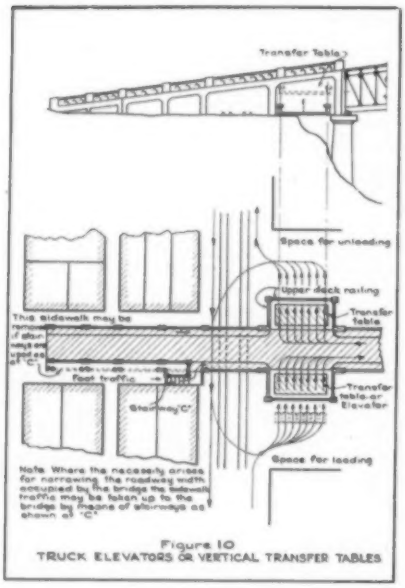

Transfer Table
Space for unloading
Upper deck railing
Transfer table
Transfer table or Elevator
Space for loading
Note: Where the necessity arises for narrowing the roadway width occupied by the bridge the sidewalk traffic may be taken up to the bridge by means of stairways as shown at "C"

Figure 10
TRUCK ELEVATORS OR VERTICAL TRANSFER TABLES

Second Streets than would otherwise be needed.

(2) The construction of a series of ramps to connect First Street with the bridge. This construction might perhaps involve a greater expense than the first solution and would not separate fast and slow moving traffic. Figure 9 indicates a double track single ramp connection to First Street. If conditions warranted the expenditure, two single-traffic ramps, one leading north and the other south, as indicated by the dotted lines in Figure 9 might be considered.

(3) The construction of a heavy traffic or truck elevator or vertical transfer table, as shown in Figure 10.

(4) A spiral approach from First Street to the bridge.

(c) Provision for traffic egress and ingress for the business places facing the bridge.

From a consideration of Figure 8 it will be observed that the presence of the bridge structure results in a restriction of roadway width adjacent to the property facing the same. When the residual roadway width is so small as to seriously obstruct traffic, special consideration must be given to this phase of the problem. The following solutions have been adopted in certain instances in past practice:

(1) The widening of the approach roadway to extend clear across the street. (See Figure 11a.) This procedure involves a remodeling of the fronting buildings and converts a portion of each lower story into basement area. The expense involved is generally very large, but the general effect is good.

(2) The use of "Arcade" work to afford greater traffic way, is shown in Figure 11a and 11b. Generally the arcade width is just sufficient for the foot walk. However, a double traffic way and foot walk may easily be provided in this manner, as indicated in Figure 11b.

(3) The removal of sidewalks from the approach bridge structure throughout a portion of the length of street frontage and the use of stairways or inclined ramps for connecting sidewalk traffic with the bridge. (See Figure 10.) This arrangement has been used in certain cases, but is open to the objection that pedestrians do not like to climb stairs and in general will take the roadway up to the main bridge structure, even though no sidewalks are provided, thus introducing an element of traffic danger.

Any of the above methods involve a considerable outlay of expense. In certain cases this expense has been offset, to a certain extent at least, by converting the area under the bridge approach into small shop or storage rooms, as shown in Figure 11b. In certain districts the rental value of such space is considerable. It should be noted, however, that as a general rule it is desirable that the approach structure be left open in order to afford better lighting and vision for the abutting business places. In fact, in many instances viaduct construction is employed for this purpose, even though retaining walls and filled approaches would be much cheaper. In the case shown in Figure 8 alley "C" should be kept open in any event.

The several points heretofore discussed are but a very few of the many traffic problems which may operate to control type selection; in fact, even the briefest possible treatment of all such problems would fill a volume in itself. There is, for example, the question of pedestrian traffic, its rate of speed under varying conditions and provision therefor, the question of moving walks, escalators and stairways, shuttle car service, arrangement of car tracks in reference to traffic plazas, comfort stations, methods of crossing vehicular and pedestrian traffic, parking storage, and a thousand and one other items which go to make up the traffic features of any bridge study.

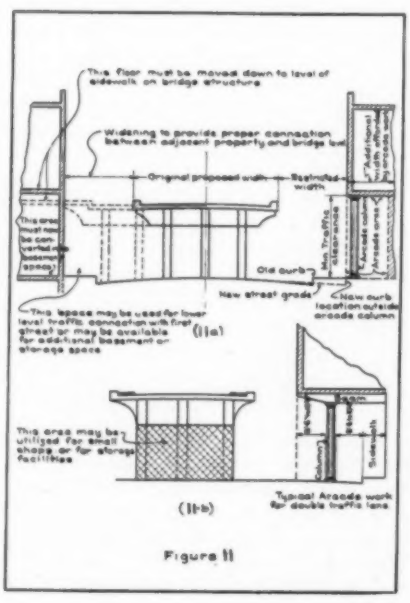

This floor must be moved down to level of sidewalk on bridge structure
Widening to provide proper connection between adjacent property and bridge line
Original proposed width
Old curb
New street grade
New curb location outside arcade column
This space may be used for lower level traffic connection with first street or may be available for additional basement or storage space
(11a)
This area may be utilized for small shops or for storage facilities
Typical Arcade work for double traffic lane
(11b)

Figure 11

The point to be made in connection with this discussion is simply that all such features operate to place certain limits on type selection, generally in regard to the spacing of piers, arrangement of trusses or girders, arrangement of sidewalks, type of approach construction, choice between through and deck construction, grades, clearances, roadway widths, etc. All such matters, therefore, must receive careful and individual consideration before the economics of the problem can be applied.

England's Traffic Problem

England is worrying about its traffic problems. According to the Engineer, "There are many prophets in the land who seek to make our flesh creep by pictures of what our roads and highways will be like after a few more years of intensive production on the part of motor car factories. The total number of motor vehicles in use in the country is admittedly increasing at a very pronounced rate. All classes included, the increase has been maintained at about 200,000 per year for the past seven or eight years. Since 1919 the grand total has increased from 271,000 to 1,865,000 in 1927. Excluding the motorcyclists, of whom there are now 681,000, the private motor car owners, numbering 787,000, dominate the situation. In 1911 there was one private car to 870 people in this country. Last year there was one to every 56 people. In this respect we are in a happier position than the United States, where every sixth person in her immense population owns a car. Italy, on the other hand, is in the relatively blissful condition of having but one private car to every 353 of her population." The article goes on to say, "Is there any limit in sight to the expansion of that traffic or are we to believe with the prophets that we are shortly to witness a state of road congestion of a staggering order?"

Quoting further, "According to a certain learned judge the minimum income [which a man should possess before he is justified in owning a car] required is £1,500 [approximately $7,300 per year]. On that basis more than two-thirds of the private car owners in this country at the present moment are open to censure." * * *

"Finally, we cannot doubt that, rightly or wrongly, there are in this country many car owners whose incomes are far less than £400 [approximately $1,940] per year. * * *

"Let us therefore disabuse our minds of any false suggestion of an immediate limit to the number of vehicles using the roads."

Cut Back Asphalt and Other Surface Treating Materials

Survey of Prevailing Practices in Their Use

By HERBERT SPENCER
Standard Oil Company of New Jersey

THE development of surface treatment both as regards methods of operation and materials used has reached a point which requires a careful analysis of what has been done to date and the establishment of such safeguards as will indicate the proper course to follow in the future. All road building movements are actuated by economic necessities and by the desire to secure the maximum enjoyment which our means permit. The evolution of the trail to the wagon road and on through various stages to the modern high speed road of today is but an expression of our progress and the urge is still upon us to provide more and more miles of roads to take care of the ever-increasing automobile traffic. This can be accomplished largely by the development of the secondary roads.

The growth of the macadam road reads like a romance, taking a hundred years or more to bring to perfection, as measured by the standards of today. Although somewhat obsolete, it illustrates the fact that only by slow and painstaking growth do we approach perfection in road building. The same may be said of all other kinds of pavement, whether of asphalt, of brick, or block or the various other materials used in construction.

The Improvement of Secondary Roads, a Necessity.—The linking up of the large centers of population by hard surfaced pavements has accomplished wonders in our transportation problems, but the small percentage as compared with the total makes us realize how far we still have to go in order to make an appreciable showing against the vast mileage of unimproved roads in the United States, as the financial burden alone is too great to consider an undertaking of such magnitude, except by easy stages. But with the increasing demand for roads, our attention is directed to the lateral or secondary roads, which call for improvement as urgently as the primary roads. The type of surfacing, however, need be only in proportion to the traffic using the road, and it is in this field that our ingenuity and initiative can be given full rein with the best chances of success.

When we consider the great variety of materials constituting our unimproved road surfaces, it seems almost hopeless to so manipulate them as to make the effort worth while. Gravel, with varying proportions of clay and silt, loam and topsoil, sand in endless varieties, shale, lime-rock, marl, shells, are but a few of the conditions the highway engineer is confronted with. It has been found that most of these materials have been used with more or less success as road bases adequate to a certain volume and character of traffic, but only recently has any endeavor been made to utilize them in a way which would make them comparable with the higher forms of paving as far as serviceability is concerned. Thomas H. McDonald, in an address before the last Asphalt Paving Conference in Atlanta, struck the keynote when he said:

"There is such a tremendous mileage of roads initially improved on which the surface is not now adequate, that a low type of supplemental construction must be developed which can be adequately maintained. * * * There are long mileages of roads on both the state highway and local highway systems, on which the only hope now apparent of first class highway service lies in the development of bituminous construction. * * * It does not appear impossible to develop processes, and the bituminous processes seem most adaptable for the purpose that lend themselves to a complete overhauling at intervals and through such overhauling, largely restore the road to its original condition without impossible expense. * * * That we are obtaining so much service from even poorly built roads which have been rehabilitated with bituminous treatments and that progress has been made in the development of good bituminous types of great promise, are facts which indicate that in this field of bituminous construction lies the hope of large mileages of highways that may render satisfactory service within reasonable costs."

And it is by the bituminous processes that we can expect a solution of our low cost road program.

The utilization of sand-gravel mixtures containing no clay or other binding material together with asphalt has been in progress fully 15 years, and is well typified by the Cape Cod, Mass., roads and by the roads on Eastern Long Island. The progressive method of gradually building up a surface by successive applications has been adopted in these cases, and results seem to justify the procedure decided upon. However, when we encounter the formations containing clay in combinations with either sand or gravel, a totally different set of conditions is before us, and often requiring considerable experimentation in the solution and application of a bituminous material in order to secure the best results.

Early Use of Asphalt Surface Treatment.—The use of asphalt for surface treatment work started approximately 25 years ago, the materials at hand consisting of the Mid-Continent asphalts and semi-asphaltic oils, and the California asphaltic oils. Elimination of the dust was the prime consideration in those days, the surfaces treated consisting largely of water-bound macadam and gravel roads. Although the methods used were inferior as measured by present-day standards, it was soon discovered that the surfaces were kept intact from the wear of automobile tires and the original investment preserved. The asphalt products themselves ranged from crude oils to harder materials thinned down with slow-drying distillates, and although specifications existed, they often defined products entirely unsuited to the work to be done. The refiner, adopting processes of distillation representing the most advanced scientific methods of the day, probably turned out as good a product as was possible with the base materials at hand.

Coincident with the use of road oils there gradually developed the application of a heavier heated asphalt as providing a more durable mat than that secured by the cold application road oil. This method of surface treatment gave and is still giving satisfaction and under proper control both as to quantity and character of cover is in the front ranks of successful surfacing materials. The introduction within more recent years of the asphaltic base residues of Mexican and South American crude oils, has opened up an unlimited source for the development of materials to meet the varying conditions in all parts of the country. The road oils of former years, while serving the purpose intended, failed to set up and provide the hard mat for public demanded, and gradually there was evolved the so-called cut-back asphalt, consisting of a semi-solid base thinned down to the consistency desired by means of a quick drying solvent, generally a naphtha. The use of such a material is undoubtedly a forward step

and a great improvement over the slower drying road oils. The naphtha serves the combined purposes of so thinning the harder asphalt as to enable its use in a cold condition; of more readily attaching itself to the base, and finally of disappearing by volatilization, leaving the harder asphalt as a wearing coat.

Treatment with Naphtha Cut-Backs.—There are few road surfaces that do not lend themselves to treatment by means of these naphtha cut-backs, and it is through the medium of these materials that we will probably see the greatest development, especially in the clay-gravel surfaces predominating in most sections of the United States. The graveled sections of New Jersey, after patient investigations over many years, have been successfully treated with such a material, although in this case, a less volatile solvent is required than in other states. The state of Virginia is probably one of the outstanding states that has gone ahead in this class of work and the many hundreds of miles of excellent surface treated roads but gives an indication of what can be expected. North and South Carolina, Georgia, Florida, Michigan—in fact, practically every state that has gravel has potentially a solution of their low cost road program. The experimental work already done is but a forerunner of greater success, for it is only by careful examination of the materials we deal with, and selection of the asphalt material best suited for the conditions at hand, that will result in complete success. The top-soil roads of North Carolina and other Southern states varies somewhat from the gravel formations found in Michigan, Indiana and other sections, but by careful selection an asphalt cut-back has been developed that converts these well-nigh impassable roads into thoroughfares capable of sustaining a traffic far in excess of that originally planned. Similarly with the excellent work being done in Florida, Georgia and other sections of the South.

Soils containing a minimum of gravel have been treated with naphtha cut-back materials under the so-called mixed-in-place method, with varying degrees of sucess. Hardly enough is known of this method to predict just what can be looked for in the future, but the road engineer, being a believer in the old slogan, "If you don't succeed, try, try again" will eventually work out something that will satisfy him. The literature on the subject of surface treatment is meager, but such as it is, it indicates the work has been done, and engineer and highway officials should be encouraged to write more of their experience and just what they are doing.

Need for Preparation of Base.—Any road before treatment with a cold surface material, especially a naphtha cut-back, should be placed in suitable condition. These states where the greatest success has been apparent, have first built roads and then treated them. The old idea of merely spreading a black asphaltic material over the road, covering it, and expecting miracles to result, has gone by the board in this day of enlightened highway development. The weakest link in the chain of treatment operations is the lack of care given the base, and poor results are too often attributed to the asphalt material which can be laid to improper preparation of the base. The smoothness of the surface will follow that of the base; if a road is built true to cross-section and profile, with ruts and holes patched, surface carefully swept, the chances of success are much greater than where these details are omitted.

Material Saved by Surface Treatment.—Much has been written on the annual cost of replacement of gravel due to wear, and this alone should serve as a guide to most highway departments as to the proper course to follow. With the application of suitable asphaltic surface treating materials, this loss is reduced to practically nothing, and in many cases the cost of treating these roads is offset by the saving effected. Gravel roads constitute over 50 per cent of the total surfaced mileage in the United States, and the material is available from Maine to California and from Louisiana to Washington. Untreated gravel surfaces are seldom satisfactory for more than 500 vehicles per day, but where properly treated, their capacity for traffic is easily doubled. It does not require much computation to show that where the cost of maintenance runs as high as $700 to $900 per mile, the advisability of some form of surface treatment is apparent.

Character of Asphalt Materials.—A word as to the character of asphalt materials available for surface treatment work. The refiner and the local highway department jointly shoulder a burden in this respect, and one is equally dependent upon the other. If the highway engineer, after years of work, has finally narrowed down his specifications to a product he knows is satisfactory, and can express his wishes in terms that leave no doubt as to the material desired, the only obligation the refiner has to perform is to comply with such specifications. All too often, however, these specifications do not adequately express just what is wanted, and different interpretations can be, and are made by different refiners, resulting in a variety of products, not entirely suited for the purpose intended. On the other hand, the refiner, from his more intimate knowledge and handling of refinery products, is in a position to recommend changes in specifications which improve the product. The extent of cooperation between the refiner and the user is often a measure of the success of an asphalt, especially the grades under discussion. A multiplicity of requirements serving no useful purpose is only a hindrance and confusing both to the refiner and the testing laboratory. For instance, a group of North Atlantic states specifies a total of 26 different requirements and the number of grades necessary to meet these exacting specifications constitutes an economic waste, reflected in higher cost to the consumer and often in needless and expensive delays to the contractor. There is often overlapping requirements, making it compulsory to carry a large number of grades in stock, whereas by some cooperation on the part of the various highway departments, these grades could be materially reduced, with no loss to the consumer, and with better insurance of uniformity and service.

The very nature of cut-back asphalts requires care in their manufacture not ordinarily appreciated by the state testing laboratory, and unnecessary and often too rigid requirements serve to destroy the very purpose for which they are designed. It is a healthy sign that both the industry at large and the larger users of these materials appreciate this situation and that steps are being taken to correct the many conflicting and overlapping requirements at present existing in these specifications. A group of southeastern states have already tentatively agreed upon a form specification which, it is believed, will insure a more uniform material and allow for better control at the point of manufacture.

Treatment of W.-B. Macadam and Other Stone Roads.—The water-bound macadam road has presented a problem for many years, and there is not much doubt that the investment made has been preserved by the treatment with some bituminous material. The naphtha cut-back asphalts readily lend themselves to this class of surfacing as by their use a wearing surface is secured which protects the stone from disintegration and yet does not result in waves due to excess material. This material is suitable for formerly treated bituminous roads, for well compacted gravel roads and for the penetration type. The progressive method of treating gravel roads that contain little or no clay is in favor in many localities, first allowing the gravel to become well compacted under traffic, and adding new material where necessary. Frequent applications of about ¼ gal. per square yard with stone or gravel cover is used, until a smooth even surface results.

The lime rock and marl roads so common in Florida and certain western states have been converted into excellent highways by means of hot asphalt applications. Those materials are easily worked and the base can be brought to exact cross-section more readily than with either stone or gravel. The priming material is allowed to thoroughly saturate the top of the base, after which it is broomed off, and heated asphalt applied. The cover material which has been found most suit-

able is slag chips applied at the rate of 35 to 50 lb. per square yard.

The utilization of existing road material is essentially the function of the highway engineer and it depends upon his initiative and experience that ultimate success will be accomplished. The use of bituminous materials is a means to an end, and it follows that where road materials have proven unsatisfactory in the past, a way is provided through combination with asphalt in some form to make successful use of such material. What has been done to date has been accomplished only by experiment, and although often failures have been encountered, those should but serve as guides for further work, until a satisfactory method is developed. Certainly the excellent results already secured, and the importance of the question should be a sufficient spur and incentive for every state to at least make an effort to settle their own low cost road problem.

Activities of U. S. Bureau of Public Roads in Past Year

Reporting on the year's activities of the Bureau of Public Roads, Thos. H. MacDonald, Chief of the Bureau, emphasized the functions of the bureau as a research organization operating in behalf of all road building agencies, and also the service of the bureau in coordinating the various highway systems, including those designated as Federal Aid, State, Forest and Park highways.

The report made public on Nov. 24 by Secretary of Agriculture Jardine summarizes the work of the bureau for the year ending June 30, 1928, and includes detailed reports of work done in each state, of sums expended and results achieved by the highway engineers, and also of the various studies of drainage, irrigation, machinery, and farm construction which have gone forward under the Division of Agricultural Engineering.

"During the fiscal year 1928," says Mr. MacDonald, "improvements were completed on 8,184 miles of Federal Aid road which had not previously been improved with Federal assistance. Advanced stages of improvement were completed on 2,014 miles. At the close of the year initial improvements were in progress on 9,494 miles and advanced or stage construction was under way on 1,285 miles."

The total cost of the 8,184 miles of initial construction and the 2,014 miles of stage construction completed was $205,043,784, of which the Federal Government paid $88,056,984, or 43 per cent, and the States the balance. The largest disbursements during the year were made to Illinois, Iowa, Kansas, New York, Pennsylvania and Texas. To each of these States the Federal Government paid during the year more than $3,000,000. All other States received less than that amount.

Mr. MacDonald discussed at length the attitude of the bureau in regard to toll bridges. He reiterated the hope that "the use of Federal Aid funds in payment of a part of the cost of important bridges would be continued," and said these funds "offer an avenue of escape from the dilemma which confronts the highway departments of many of the states," which are torn between the desire to erect bridges which must be expensive and the desire to give some improvement to long stretches of roads in rural districts.

"Taking advantage of this hesitation, private promoters have been busy acquiring exclusive franchises to build bridges at commanding locations on the publicly-built highways, and in compensation therefor to levy toll upon the annually increasing number of travellers."

The bureau found that, on October 31, 1927, there were 424 toll bridges in operation, under construction or proposed, of which 217 were on the Federal Aid highway system. In the last Congress bills were introduced to authorize construction of 122 toll bridges, and 67 were authorized. Practically three-quarters are or will be operated by private interests. Originally the law prohibited use of Federal funds for roads which serve as immediate approaches to toll bridges. Congress recognized that this might at times be desirable, and authorized Federal appropriations in payment of half the cost of public bridges, the State's portion of which is to be met by bonds repayable from toll collections. This, says Mr. MacDonald, has proved a feasible solution, and such toll bonds command an active market and more favorable terms than those placed by private interests. Public building also assures open competition in construction bidding.

"In consideration of these and other facts," says Mr. MacDonald, "the bureau generally opposes the construction of private toll bridges and favors construction under public auspices whether or not it is necessary to resort to tolls as a measure of finance. It has recommended against the granting of authority to private interests in numerous cases, when congressional bills have been submitted for its consideration; but in many cases its recommendations have not been followed. The facts in its possession were placed before Congress at its last session; and it is hopeo that a careful consideration of these facts will lead that body to extend the legislative support needed and earnestly desired by the highway administrative authorities of the Government and the States in dealing with this difficult problem of major bridge construction."

Mr. MacDonald also comments on the advertising signboards which often carry misleading information and hide publicly placed guides or confuse travellers. He continues: "Designedly placed where they will receive the utmost attention, they frequently obscure or mar attractive roadside views and so detract from the pleasurable use of the highways. Accustomed as we are to their unwanted presence in ordinary surroundings, to come upon these blatant commercial appeals high on the face of a majestic cliff, marring a mountainside, or completely obscuring a particularly beautiful vista, still awakens a sense of their utter incongruity. In practically all cases these roadside advertisements merely repeat in the same form appeals made quite properly through other agencies. Their disfigurement of the landscape is a national disgrace."

Highway research by the bureau has included the Cleveland planning survey as the principal economic project dealing with efficient and economical highway construction for the service of the community. The physical researches have included studies of subgrades of highways to determine the most economical paving which will prove adequate on subgrades of different soils; investigations into low-cost road construction carried on cooperatively with the highway agencies of California and South Carolina; investigations of motor impacts imparted by trucks; the highway bridge investigations including the observations made on the Pee Dee River bridge in North Carolina, which gave highway engineers their first opportunity for large scale tests of the formulas on which concrete arches had been constructed; observations of several test sections of highway; concrete investigations; concrete mixing investigations; studies of highway production economics, of mechanical finishing of pavements, and of efficiency in steam shovel operations.

The activities of the Division of Agricultural Engineering included irrigation investigations, such as studies of "duty of water," of losses by evaporation, of pumping, of control of silt and gravel, reclamation of alkali land, drainage of irrigated land, and irrigation in humid regions. The drainage studies included continuing work in run-off and ditch capacities, ground water investigations, work on soil erosion, tests of tile, operation and maintenance of pumping plants, the flow of water around stream bend and bridge piers, and investigations into the organization and development of drainage districts. Extensive experimentation went forward with apparatus for control of the corn borer, and on numerous other kinds of farm machinery.

Brazil Passes Law Authorizing Highway Bond Issue.—A law authorizing the issuance of bonds for highway purposes has been passed. It is rumored that a $20,000,000 foreign loan secured by these bonds has already been negotiated.

Brief History of Pennsylvania Road Development

An Outline of Highway Development in the Keystone State

By SAMUEL ECKELS
Chief Engineer, Pennsylvania Department of Highways

THE history of road development in Pennsylvania is a highly interesting one. The development of our pioneer roads, which form the ground work of our present Pennsylvania highway system, laid a foundation for the expansion of this nation in the west and for its great economical development. Not only that, the history of the development of these United States is the history of transportation.

The cow-path and the Indian trail or primary road became the route of the stage coach, Conestoga wagon, and pack train of the emigrant, from which evolved the country road, turnpike and mail route; in fact, they became the veins and arteries of the body politic through which flow the agricultural productions and our commercial supplies, the life blood of the Nation.

The wild mountain ranges of Pennsylvania, which cross the state in a belt varying in width from 75 to 160 miles, trending northeast to southwest, offered the same difficulties to the early pioneers that they offer to the highway engineers of today. The roads blazed over Indian trails by the pioneers largely account for our settlements in the vicinity of our main travelled highways.

The Philadelphia-Morrisville Road.—The importance of road development in Pennsylvania was appreciated by the Swedes and Dutch, who settled in and round Upland in 1643. These long-forgotten pioneers of Pennsylvania laid out a road from Philadelphia to Morrisville across the Delaware River, then through Trenton to New York, a route which closely approximates our present U. S. Highway Route No. 1. In New Jersey in 1677 it was given the name of "King's Highway." It is also interesting to record that the Dutch about 1616, laid a road extending from the Hudson River to the Delaware Flats in Monroe County.

Early Highway Legislation.—William Penn, when he founded the Province of Pennsylvania, was appreciative of the importance of road making. Through his council, he ordered that a certain portion of land be set apart for roads, the principal ones of which connected populous communities and were known as "King's Highways."

In his "Frame of Government," Penn specified in Section 10: "That the Governor and provincial council shall at all times settle and order the situation of all cities, ports and market towns in every county, modelling therein all public buildings, streets and market places, and shall appoint all necessary roads and highways in the province."

In October, 1696, the Provincial Council defined the courses and distances of two roads in Oxford Township, Philadelphia County.

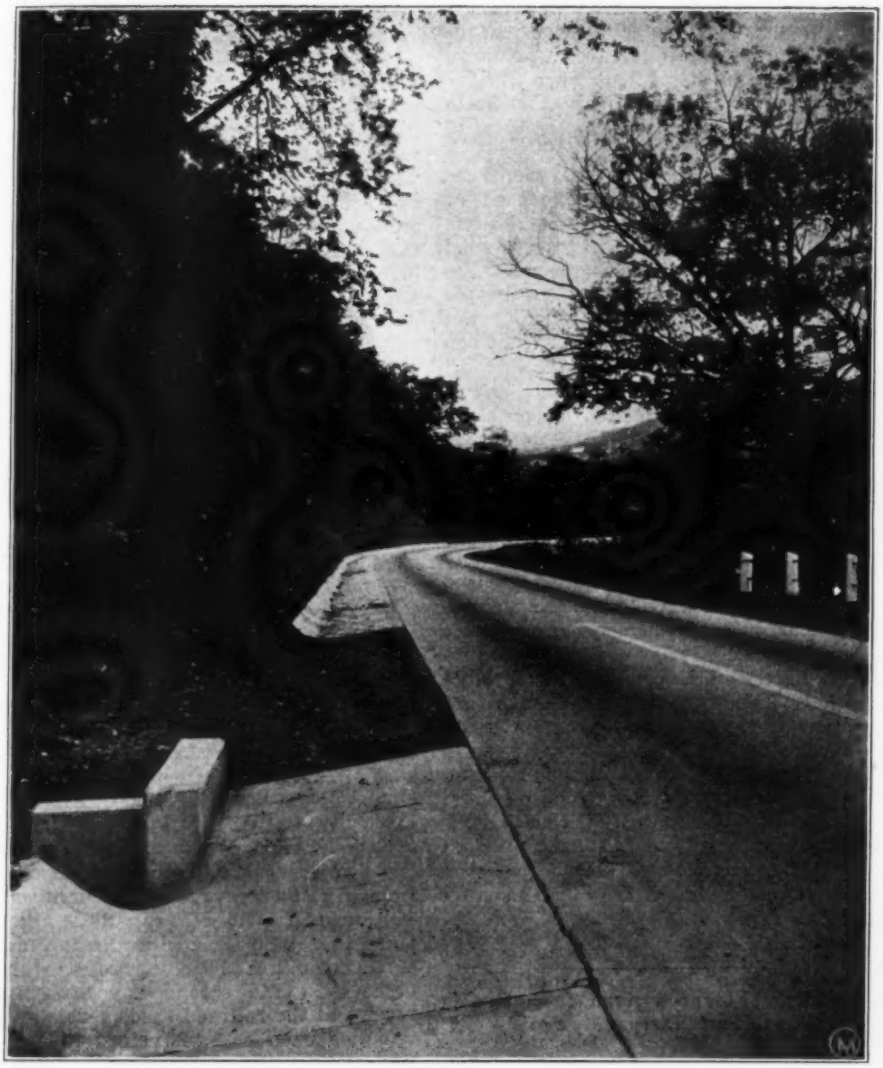
In 1700, the Colonial Council, under Lieutenant Governor William Markham, passed an act which provided "That all the King's Highways or public roads within the Province and territories, shall be laid out by orders from the Governor and Council for the time being, which roads shall be recorded in the Council Books with courses thereof as near as may be." The justices were authorized to appoint viewers for the laying out of roads other than the King's Highways and "to fix the width thereof provided that the width shall not exceed fifty feet and that the approval of the report of viewers be entered upon the record."

The Easton Road.—The Quaker, Mennonite and Moravian pioneers found Indian trails which, with widening, provided easy lanes of travel. Many of these afterward became fixtures through use, improvement and legislation. One of these early trails led from the falls of the Delaware river to Philadelphia, thence to Sussex County, Delaware, and was used as early as 1683. This subsequently was known as the "Easton Road."

Many of these roads, known as early as 1711, through indifferent maintenance upon the part of local authorities, were poorly kept up and later absorbed in the toll and turnpike systems, constructed and maintained by private corporations. The courses of the Philadelphia-Lancaster Road, the York Road, the Ridge Road, the Easton Road, and the Strasburg Road were laid before 1711 and subsequently used by the turnpike companies in the construction of the toll roads and turnpikes.

The Start of the National Pike.—While the Quakers were peacefully and quietly developing a road system in and around Philadelphia, the Virginians, who had formed the Ohio Company, realized the economic value of the lands west of the Allegheny Mountains and, in 1751, sent Christopher Gist into the valleys of the Youghiogheny and Ohio. Following the customs of the early pioneers, Gist wended his way over the Indian trails of the Allegheny Mountains. These trails practically blazed the way for the creation of the National

View on Route 34 Between Bendersville and Biglersville. Note the Clean Shoulders



View on Route 64 Near Leamersville in Blair County, Showing Method of Handling Drainage

Pike, as they were followed in 1753 by Washington and in 1755 by Braddock's army, which laid out a military road, closely paralleling our present National Pike. Nemacolin's Path, between Uniontown and McKeesport, a route laid out by an Indian chief of that name, was employed by Braddock's army in his disastrous march on Fort Duquesne. The route through Brownsville to the West, which today is a part of the National Pike, was an Indian trail followed by Cresap, Burd and other pioneers.

Congress, in 1811, then dominated by Virginia and the South, authorized the construction of what was then known as the Cumberland Road, now the National Pike. The construction costs of this highway, authorized by Congress, emphasizes another fact of vital importance to the people of Pennsylvania; that is, by reason of the mountain topography, construction costs in Pennsylvania are considerably greater than most of her sister states. In Pennsylvania it cost $13,000 a mile for the construction of the Cumberland Road, and in Ohio, a level country, the cost was less than $5,000. It will be seen that, in making a comparison of road building in other states with that in Pennsylvania, vital differences in road construction costs by reason of topographical difficulties, must always be taken into consideration. Consequently, Pennsylvania must pay more for each mile of road than most of its neighboring states.

The Turnpike System.—The call of the West and North to the pioneer was insistent and in answering this call, trails and roads were established. Commercial supplies from the centers of distribution were demanded in the West and North and the agricultural and food products in the centers of population. These two factors working in unison demanded better roads over which supplies could more easily and quickly be transported. This demand shortly after the Revolution called into being the turnpike or toll road system. On April 9, 1792, an act was passed to enable the Governor of this Commonwealth to incorporate a company for making an arterial road from Philadelphia to Lancaster, a distance of about 62½ miles. The construction of this road, at a cost of approximately $444,574, was completed in 1794. The system grew rapidly until the whole state was a network of turnpike roads, and the great desire of the trade interests soon forced the construction, under the provisions of the act of 1806, of the Harrisburg-Pittsburgh road, which traversed mainly the Old Forbes Road, opened by General Forbes in 1758. The Philadelphia and Lancaster Turnpike and the Forbes Road today practically form the Lincoln Highway, U. S. Route No. 30. The Strasburg Road, which ran from Philadelphia to York, was another pioneer road, known as early as 1711.

The movement for turnpikes accounts for the opening of the road in 1790 from Fort Pitt through Venango (Franklin), LeBoeuf (Waterford) to Presque Isle on Lake Erie. The legislature later authorized the construction of a turnpike from Waterford in Erie County through Meadville and Franklin to the Susquehanna River at Curwensville. This road was known as the "Susquehanna and Waterford Turnpike." The construction of a turnpike from Northumberland, through Bellefonte, Milesburg and Philipsburg to Curwensville was also authorized. These turnpikes were soon followed by the construction of others, which traversed main routes previously laid out by the Provincial Council or by Act of Legislature.

In 1805, the Center Turnpike was authorized from Sunbury to Reading, and this road together with the Waterford and Susquehanna Turnpike, provided for a stone road from Erie via Reading over the Ridge Turnpike to Philadelphia.

The East and West Road was laid out under the provisions of an Act of April, 4, 1807, which authorized the construction of a state road from "Where the Coshocton and Great Bend Turnpike passes through the Moosic Mountain in a westerly direction of the west line of the state." Many sections of this old road are traversed by state highway routes. In 1812, the construction of the Belmont and Easton Turnpike was authorized. This turnpike ran from Belmont in Wayne County to the intersection with the Easton and Wilkes-Barre Turnpike in Northampton County.

Two Thousand Five Hundred Miles of Turnpikes Operated in 1831.—Just as we face opposition to highway bond issues today, we find opposition to the construction of the early turnpike roads in Pennsylvania, but perseverance overcame the difficulties. Reports show that there were upwards of twenty-five hundred miles of turnpike roads being operated in 1831. The state contributed $2,000,000 toward the construction of these turnpikes. Many of them were poorly constructed, and but few of them yielded sufficient revenue to pay for the

maintenance to say nothing of remuneration to the stockholders; the lack of income caused many turnpike roads to be abandoned and the failure to properly maintain others caused them to be condemned. The maintenance of the abandoned and condemned turnpike roads then devolved upon the respective townships, boroughs or cities in which they were located. The change in maintenance authority did not improve matters to any great extent; in fact, conditions, in many instances, became worse, proving the old saying that a common dirt road is a bad road six months in a year, while an abandoned turnpike or stone road, which has been allowed to go to decay, is bad all the time.

The turnpike or toll road system had its advantages and such roads served their time and purpose, being an improvement of vast importance over the mud or corduroy road.

At the time of the establishment of the State Highway Department in 1903, Pennsylvania had 1,100 miles of toll roads. On the State Highway System only one toll road now remains, namely the New Holland Turnpike, 5.4 miles in length, and negotiations are under way for the purchase of this toll road. A few county roads still exist as toll roads.

The County Road System Begins.—The forties of the 19th century was another period of extensive turnpike road building, as was the period immediately after the Civil War, up to 1874, when the present State Constitution was adopted. Following this, interest in road construction by reason of the constitutional changes forbidding future turnpike and toll roads, highway construction slackened, but in 1889 renewed interest was taken in road development and the agitation thus started resulted in the passage of an Act of June 26, 1895, known as the Flinn Act, which provided for the organization of a county road system in Allegheny County and afterward in other counties until at the present time a number of counties are working under that act by reason of their maintenance of abandoned or condemned turnpike roads.

As methods of transportation and vehicle conveyance charged, a loud and never ceasing state-wide cry for better roads was set up. A voice which would not be stilled was that of the bicycle rider; it was so forceful that the Act of April, 1899, was passed providing for the "construction and maintenance of side paths along the highways of the townships of this Commonwealth for the use of bicycles and pedestrians; bicycle riders, however, to have the right of way thereon."

Creation of the State Highway Department.—However, about this time, the demand of the bicycle rider became intensified by that of the automobilist who was just beginning to make himself heard. To meet this hue and cry of the users of the highways and relieve the local authorities, who were charged with the upkeep of roads for which they had no funds, the State Highway Department was created in 1903.

Since the Highway Department was created, the amazing development of the automobile and truck industries has taxed the capacity of our present road system, causing ever-increasing demands for better grades, elimation of curves, wider roads and last but not least, new arteries of travel. "You cannot eat your cake and have it, too," is an old saw but a true one, and it applies to our present highway problem, for the taxpayer cannot have improved roads and keep his tax money in his pocket.

Roads must be maintained as well as built. With the construction of each new road, maintenance costs inevitably follow. If we are to meet the increased demands for new roads and the maintenance of our present ones, we must have increased revenues. The opponents of the highway bond issue, while sincere, must appreciate the fact that if our present road program is to go forward and Pennsylvania is to keep in the front rank of states famous for road development, our present road program cannot be maintained without additional funds.

Acknowledgment.—The above is an address presented Oct. 16 at a meeting of the Pennsylvania Automotive Association.

Privately Financed Road from Puebla to San Marcos, Mexico

Construction has recently been terminated on a road from the city of Puebla to San Marcos, a distance of approximately 52 kilometers, which connects the important agricultural area of the eastern part of the states of Puebla with Mexico City, and will also form part of the projected highway from Mexico City to Vera Cruz, according to a report from Trade Commissioner Albert F. Nufer, released by the Automotive Division, Bureau of Foreign and Domestic Commerce.

The outstanding feature of this road is that it was built entirely by the donations of farmers, manufacturers, merchants and private citizens on the initiative of the National Agricultural Chamber of Puebla. The services of the entire technical staff were given free of charge and only the day laborers (peons) received any remuneration for their work. The governor of Puebla assisted by offering the services of the consulting engineer and by the loan of tools, motor trucks, etc.

It is a graded dirt road, and as soon as additional funds have been raised, it will be surfaced with macadam. It passes the important villages of Chachapa, Amozoc, Acajete, Nopalucan and San Marcos.

Will Store-Door Delivery Come?

Motor trucking interests have for years advocated the collection and delivery of small railroad shipments of freight in cities by a system comparable with that of the express companies. For want of a better term this is called store-door delivery. It is maintained that store-door delivery would greatly lessen traffic congestion in the city streets, expedite the collection and delivery of certain freight, and save much valuable space in the freight houses.

This whole question was discussed at length at a session of the transportation meeting of the Society of Automotive Engineers in Newark, N. J., recently. R. A. C. Henry, of the Canadian National Railways, described the system of store-door delivery that has been in operation for the last 70 years in Canada with great success. He showed that it is an extension of the contract cartage that has existed in England for more than a century.

Referring to the Canadian National Railways, he stated that store-door delivery is now in effect on the system in the provinces of Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia in 22 cities having a combined population of 2,855,000. From 63 to 64 per cent of the total less-carload freight handled on the railway system is collected and delivered by the contract cartage system in Montreal, Toronto and Hamilton. In these cities more than 97 per cent of the inbound cartage freight is delivered to consignees by the second day after its receipt at the railroad sheds. This system has been so satisfactory to shippers and consignees that they have successfully opposed proposals made to the Board of Railway Commissioners that the system be abolished.

Other speakers at the meeting debated the question whether it is feasible to adopt a similar system in American cities. F. J. Carey, of the Boston & Maine Transportation Co., told of the application of a modification of the Canadian system in New England.

William J. Duffy, of Boston, said that definite progress for the railroads, the truckmen, the merchants and the public would be accomplished if a regulated store-door delivery system could be installed to take care of the smaller shipments.

Highway Development in the Mexican States.—Among the states which are actively interesting themselves in road construction are Tamaulipas, Oaxaca and San Luis Potosi, although in the latter two states activities at the present time are confined to short local roads. In Tamaulipas the governor has signed a contract with an American company to construct a highway from Tampico to Matamoros via Cindad Victoria, work on which is said to have already begun.

The European Cement Cartels

A Menace to an Important American Industry

THE existence of cement cartels in the various European cement producing countries, now being welded into an international cartel, is fraught with the most serious consequences to the American industry, struggling to keep its home market and yet prohibited by law from combining and using the same tactics which the European cartels employ in fighting the Americans in the American market.

By cartel is meant a central organization to which, in the case of cement, the individual producers have surrendered all control of production, prices and distribution.

The Belgian Union des Cimenteries (United Cement Mills) may be taken as a typical cement cartel.

Belgium furnishes 75 per cent of all the foreign cement used in the United States. Practically all of Belgium's shipments are furnished by the 14 mills constituting the Union.

The Union, as its letterhead shows, is a "cooperative company" and the "sales office for the above-mentioned artificial portland cement mills."

The Union controls the price, sales and distribution policies of the 14 mills —a combination in restraint of trade which, if duplicated by American producers, would soon have them brought into court for violation of the Sherman and Clayton Anti-Trust Laws with the Federal Government as the plaintiff.

Every month each of the affiliated mills places at the disposal of the Union definite quantities which the Union distributes according to the demand in Belgium and other foreign markets. All orders are routed through the Union. A mill receiving an order automatically passes it on to the Union, which checks the price, and allocates it to the mill nearest the buyer.

The Union likewise every month determines the price that all the mills must follow. With the Union in complete charge of the filling of all orders, naturally it has a check on all prices.

At the close of the year the Union's profits are distributed among all the member mills on the basis of yearly output allotted each mill. Mills exceeding their quotas pay an indemnity which goes to compensate those which have failed to reach their quotas.

This unified control of production, price and distribution gives the Belgian producers a number of decided advantages over the American in their drive on the American market. The Belgians, for instance, because of their cartel arrangement, reduce their selling and distribution charges to a minimum. In fixing prices, the Belgians offset losses in one port by profits in another American port, and spread these over 14 mills, whereas the American mills without the possibility of joint action single-handed have to fight and bear the brunt of the attack.

With Belgium forced to export more than half of its production, it can be readily seen the tremendous force her competition acquires, when directed and controlled by a single organization, against the American market, which is the most exposed market in the world.

Every producing country in Europe is controlled or dominated by a cartel. Besides the Belgian Union des Cimenteries, we have, for instance, the German Zementsyndikat, with its four regional cartels; the Danish cement ring; the British Association of Portland Cement Manufacturers; and the Swedish Cementforsaljnings.

Cement has become one of the most highly cartelized of European industries, because of the tremendous gap between domestic production and domestic consumption in the case of the various European countries—in short, overproduction.

The following table giving per capita production and consumption of the various European cement producing countries in 1927 shows the wide spread between what each country produces and what it consumes:

Per Capita European Production and Consumption—1927—In Barrels

Country	Per Capita Production Bbl.	Domestic Consumption Bbl.
Belgium	2.01	0.80
Denmark	0.95	0.41
Sweden	0.46	0.34
Germany	0.66	0.56
Switzerland*	0.75	0.55
United States	1.43	1.44

*1924

With overproduction as the main problem, these cartels naturally looked to export markets to help them dispose of their surplus cement. Between paying a mill owner an indemnity to close down or giving producers a premium out of the common earnings of all the mills on export sales, the latter course was found much easier and also more profitable. So we find the cartels disposing of their surpluses in foreign markets, in many instances at cost of production. The more units produced, the lower the unit manufacturing cost and, with an absolute grip on the home market, the more profits on domestic sales.

Unlike the American cement producers who have bent their energies towards promoting the consumption of cement at home with the result that the United States has by far the greatest per capita consumption in the world, we find, on the contrary, European producers emphasizing export trade to the point where a number of countries foreign consumption is far greater than domestic. Belgium, for instance, exports 70 per cent of her total production; Denmark, 55 per cent; the United Kingdom about 20 per cent. In marked contrast stands the United States, which exports about one half of one per cent of her production.

If there is one lesson that the European cement producers have learned, it is, that it is much more profitable to combine and enter into agreements than to indulge in price-cutting wars. True, the cartels are all-powerful because of their control of all the mills; and yet, their policy of keeping prices so high, results in the home market being particularly sensitive to foreign competition.

In the last three years there has been a great increase in the number of international agreements between the various European countries, that is, entered into by the various domestic cartels. Numerous agreements have been concluded whereby each party agrees to respect its neighbor's home market in return for the promise it will have the fullest control of its own. Belgium and Germany, in entering such agreements, also stipulate that the other countries will keep out of the Dutch market which represents both Belgium and Germany's leading export market and which those two countries early in 1928 divided on a 50 per cent basis.

The following represent a partial list of international agreements drawn up in the last year:

1. Belgium, France, Luxemburg—whereby Belgium agrees to limit her exports to France in exchange for France's promise to keep out of the Dutch market.

2. Germany, Norway, Sweden, Denmark and Poland—In reference to the Baltic markets and possibly to overseas markets.

3. Belgium and Denmark—whereby each agrees to respect the other's market and in addition Denmark agrees to keep out of Holland.

4. Belgium and Germany—whereby they divide the Dutch market between them and agree to respect each other's domestic markets.

The recent Belgian-German division of the Dutch market may be taken as indicative of the action of these countries in a market where once they have gained complete control. For several years the German cartel sustained tremendous losses, dumping cement in Holland in an effort to make the Belgians come to an agreement regarding the partitioning of that market. The Ger-

man cement industry when selling cement in its home market at $2.10 per barrel, was furnishing the same product laid down at Rotterdam at 91 cents. Once the Belgians had come to terms, the Dutch market was quickly divided and prices immediately increased. In the first three months that the agreement was in force, prices to the Dutch trade were advanced from $1.10 to $1.66 per barrel.

Exports to North and South American markets constitute a more important part of European production than those to contiguous countries. With the international trade in cement becoming increasingly keener every year, because on the one hand, of the elimination of competition in Europe, and because, on the other hand, of the desire of South American countries to produce their own cement and protect their industries from unfair European competition, there has been a movement in Europe to consider the means of welding the various cartels and European agreements into an international cartel having for its purpose the partitioning of overseas markets in the same way as has been done recently in the case of Holland. And considerable progress has already been made along such lines.

Any international cartel working toward partitioning of overseas markets will center its attack upon the American market since it offers the greatest outlet for European overproduction. It is the most exposed market in the world. High wages and lack of tariff also make it particularly vulnerable.

Though information is lacking as to whether the international cartel has been completed, yet the progress made in Europe during the past year in the formation of agreements between the various continental producers have added immeasurably to their competitive strength in consolidating and increasing their hold upon the American market. To suggest a few of the present effects of the European agreements entered into recently:

1. These agreements strengthen the cartel system in Europe, which means that European producers when competing in the American market work as a unit and enjoy a freedom from competition which is expressly forbidden the American producers. The Americans in resisting the invasion are forbidden to combine.

2. The cartel system means not only elimination of competition, but also keeping prices high and unchanged in Europe. It makes for greater profits and resources at home; renders it more profitable to dump in export markets; and gives Europe greater resources for beating down American opposition in the American market.

3. The division of a market like Holland gives Germany and Belgium a second important base where profits are high.

4. Precedents have been established whereby a number of European producers can leave one of their number in control of an overseas market in exchange for concessions in other fields. For instance, European cartels have become so adept in promoting international agreements and partitioning markets in Europe that it would be a comparatively easy thing for European producers to withdraw from the American market, leaving Belgium as the only European representative, in return for concessions which Belgium might make to European producers in markets which are not so important to Belgium.

In short, the trend of European cement industries has been to substitute the national cartel for national producing units. At present there is a movement to weld these national agreements respecting European markets into an international cartel, dividing the world into spheres of influence. Against this trend of internationalism, the American industry is compelled to fight as individuals. The American anti-trust laws expressly prohibit them from combining in the same manner as the European producers have done in the case of the American and other overseas markets.

Grade Crossing Protection in Pennsylvania

The Pennsylvania Department of Highways began a comprehensive movement to protect railroad crossings when bids were received last month for 50 advance warning signals of the continuous flashing type. The new signs are to be installed at grade crossing approaches where vision is obstructed and the driver suddenly comes upon the tracks. The bids included also 50 markers for dangerous bridge or underpass approaches at grade separations.

The highway department specifications for the new signs require that they be modelled after the standard sign in use at present in Pennsylvania and most other states, consisting of metal with a cross and the letters "R. R." imposed on the target portion. The cross on the new signs will be illuminated by a flashing device in continuous operation, the letters equipped with the familiar reflecting device so that they will flash into view at night only when the lights of the approaching vehicle strike them. During daylight only the flashing cross will be illuminated, although the letters will be plainly visible.

The new signs will be yellow with black outline, emitting an amber flash. They will be placed well in advance of the dangerous spot. At the actual danger point the standard railroad warning with red flashes will be in operation only when a train approaches and closes the track circuit.

About 1,500 grade crossings in the State have "blind" approaches. The railroads and the department will share the cost of installing the signs.

The second type of marker, for approaches to grade separations such as bridges and underpasses, will be of the diamond-shape type, similar to those now in use as "Thru-Stop" highway intersections. The new signs, however, will include a flashing diamond over the word "Slow," which will be in continuous operation, self-illuminated day and night.

Pennsylvania is stated to be the first state to undertake a systematic, complete marking of dangerous approaches to grade crossings and grade separations. Its own specifications were developed for the advance signals.

Toll Roads for Commercial Traffic

The toll road developed to a high point of efficiency to give service to motorists and operators of commercial bus and truck fleets has an economic standing today and may be one of the important coming developments in application of motor vehicles to modern transportation needs in the United States, according to the conclusions of Piero Puricelli, president of the Societia Anonima Autostrade of Milan, Italy, and honorary vice-president of the National Highway Traffic Association, who will submit an interesting report on toll roads at the annual meeting of the association at the Automobile Club of America, New York City, Dec. 10, 11 and 12.

Signor Puricelli has headed the construction of a system of express motor toll highways between the principal cities of Italy, and in his work has had the support of Premier Mussolini.

The growing trend to operation of vehicular tunnels, bridges, and other facilities for saving time and distance for motorists on the toll basis is leading to a demand in some quarters for high speed, express highways in this country, engineers find.

However, Signor Puricelli's conclusions in his report on "The Economic Status of Toll Roads" are as follows:

"Toll roads do not conflict either with public or with private rights. In the field of private rights, they represent a contract relation on the type of the transport contract between the owner of the road and the user. In the field of public rights, they are subsidiary to the network of the ordinary highways and therefore subject to the control and coordination of the state."

"The creation of such roads must be called for by special conditions of locality and traffic, and placed in relation to the already existing network of highways, which must be developed to the highest degree by the public authorities.

"The amount of the tolls must be in direct relation to the advantages which the actual user of the road derives from the same."

Some Considerations in Selecting Roadway Types

Necessity and Adequacy the Principal Factors

By C. N. CONNOR
Engineer Executive, American Road Builders' Association

THE selection of type for low cost road surfaces is based on two principal factors, necessity and adequacy. Necessity is evidenced by the immediate need of a long mileage of roads of this class in communities which have insufficient funds for long connected mileages of high type surfaces.

The adequacy of certain materials for surfacing has been demonstrated by states which have used them extensively either as untreated surfaces or with surface treatments.

They will quickly become inadequate without careful construction and intelligent maintenance.

Influence of Local Supplies.—Selection of untreated surfaces is based primarily on the availability and cost of suitable local aggregates for construction. They should be of such quality and gradation that their immediate surface can be bladed or dragged at frequent intervals by motor driven equipment. Untreated surfaces which meet these requirements are sand-clays, gravel, shale, chert, disintegrated granite, traffic bound surfaces of fine stone, slag or gravel and caliche.

Macadams and lime rock need a layer of gravel or fine crushed stone before they can be maintained by blading.

Surface treatments with non-bituminous dust preventives are adequate when maintained by frequent blading or dragging.

When Surface Courses Are Adequate.—Bituminous surface treatments or surface courses are considered adequate provided they are susceptible to scarifying, reshaping and retreating at periods of from 1 to 3 years and do not exceed about $1,200 per mile for this work and the materials. Such types are the dual bituminous surface treatments and the mixed-in-place bituminous surfaces.

Surfaces which approach or include the pavement types, such as bituminous macadams, natural rock asphalt and the pre-mixed bituminous surfaces which are laid hot or cold are not as readily maintained by scarifying, reshaping and retreating, and they are not as frequently selected for low cost surfaces.

The riding qualities of a surface are of prime importance. These types, which include blading, dragging or screeding in their construction or maintenance have better riding qualities than those which do not.

Types are desirable which under maintenance or reconstruction can be renewed by the addition of small quantities of new materials as required and without serious interruption to traffic.

The reconstruction and resurfacing of old existing surfaces which have been compacted through years of traffic is frequently possible and advisable. This new surface is usually one of the low cost bituminous types.

Progressive or Stage Construction.—Progressive or stage construction is now recognized as a sound economic policy.

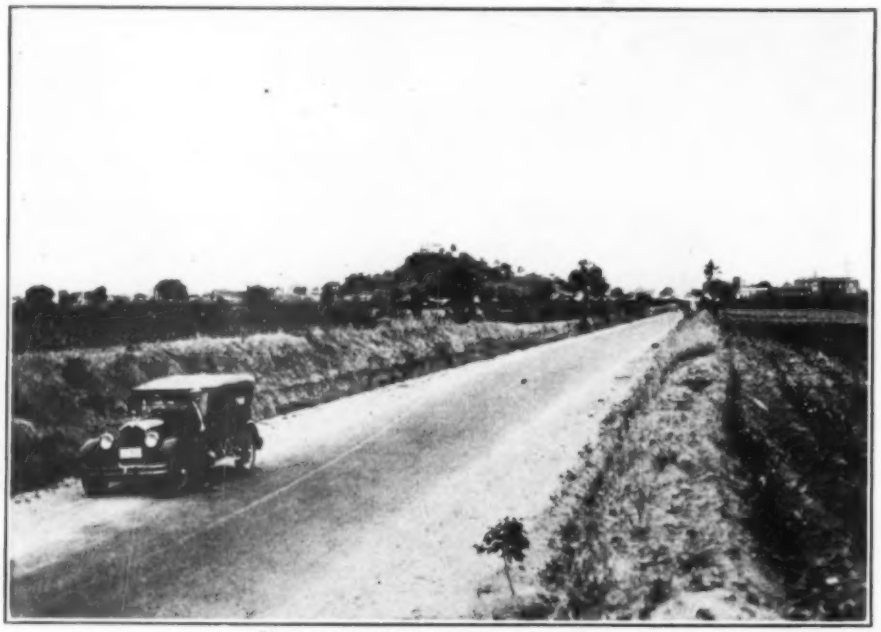
It means the gradual improvement of a highway, first by proper grading and draining; second by the addition of untreated surfacing aggregates either in this layer, placed at periodic intervals as required, or placed to a greater depth in one operation.

As traffic demands increase this untreated surface is given one of several types of surface treatment. When traffic requirements become still more severe, a pavement type of surfacing may be indicated. By this method of stage construction, the original investment has not been lost because the materials already in the road have given adequate service for the changing conditions of traffic and the weak spots in

Stage 1, Clearing and Grubbing

Stage 2, Graded and Drained

Stage 3, Untreated Surface of Local Materials



Stage 4, Macadam Surface Treatment

Stage 5, The Pavement

the subgrade have been corrected under maintenance.

In the last stage, the existing untreated or treated surface is of value as a subbase for the pavement type.

While it is true that tests have shown a greater cost of vehicle operation and tire wear on gravel and stone surfaces than on pavement types, yet it has not been shown by research or test what it costs the owners of vehicles to be without these gravel and stone surfaces.

It is also probable that tests on surface treated gravel and stone would show a considerable reduction in vehicle operation costs below those for the untreated surfaces.

There is small doubt that expensive pavement types have been constructed where a surface of less than half the cost would have been adequate. The desire to cut maintenance costs, to avoid the inconvenience of perpetual surface maintenance, and the lack of knowledge or of equipment to perform this maintenance have been the principal reasons for such selections.

Climatic and soil conditions apparently have not been of major importance in selecting low or high type surfaces because treated and untreated gravel is found in nearly every state regardless of the local conditions.

There is no doubt that the unit weight of vehicles is a factor which cannot be ignored in the selection of type. If the present or probable traffic is to include even a small number of heavy trucks, equipped with solid tires, low type surfaces will frequently become inadequate.

Recently, buses, the milk trucks, and gasoline trucks have become a factor which must be considered or regulated when making a selection of surface.

Selection of Type a Prescription Proposition.—An engineer who is already familiar with the local conditions of his own surfaces, available materials and funds, will do well to make an examination of the work done by others under similar conditions. His final choice will be more easily and intelligently made.

In spite of the deterring factors and perplexing problems involved in selection, low cost road construction has been found necessary and must continue as evidenced by this recent statement from the Chief of the Bureau of Public Roads:

"As a matter of fact, to a large extent all highway construction must be stage construction, and there can be no just criticism of whatever is undertaken if it be undertaken intelligently with a well-defined conception of the future development and if the execution of the idea is efficient."

Acknowledgment.—The above paper was presented at the 7th Annual Asphalt Paving Conference.

A Proposed Federal Superhighway System

Senate Bill Proposes Large Mileage of 4-Track Highways

A SUPERHIGHWAY program, the largest ever undertaken in any country, is proposed in Senate Bill 1900, introduced by Senator du Pont of Delaware. It is understood the bill will come up at the next session of Congress, backed by a favorable report of the Senate Committee on Post Offices and Post Roads. The bill, in brief, provides for the construction of four war post roads and military highways from (1) the Atlantic to the Pacific Coast; (2) from Maine to Florida; (3) from the northern boundary of the state of Washington to the southern part of California; (4) from a southern point in California through the southern states to connect with the eastern seaboard highway; (5) a highway from the coast to coast highway (Central highway) northwest to connect the western seaboard highway in the state of Washington; (6) a highway from the coast to coast highway south to connect with the highway through the southern states.

The magnitude of the project and the proposed method of financing it make the bill of particular interest, and it accordingly is reported below. The first part of the bill establishes a national survey commission, which is to make preliminary examinations and surveys and report to Congress. The balance of the bill, Titles II and III, presents practical suggestions to a future Congress, upon whose action will depend whether construction is authorized.

[S. 1900, Seventieth Congress, first session]

A BILL to provide for the construction of a post road and military highway from a point on or near the Atlantic coast to a point on or near the Pacific coast, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress Assembled,

Title I.—National Survey Commission Organization and Administration

Section 1. (a) There is hereby established a commission to be known as the national survey commission (hereinafter in this act referred to as the "commission") and to be composed of the following:

(1) The Secretary of War.
(2) The Secretary of Agriculture.
(3) The Secretary of the Treasury.
(4) The Secretary of Commerce.
(5) The Postmaster General.
(6) Six individuals appointed by the President, by and with the advice and consent of the Senate. Such appointments shall be made with due regard to the appointee's knowledge of highways and highway construction, general engineering knowledge, and business experience. No more than three of such individuals shall be from the same political party.

(b) Vacancies in the commission shall not impair the power of the remaining members to execute the functions of the commission, and shall be filled in the same manner as the original appointments. A majority of the commissioners shall constitute a quorum for the transaction of the business of the commission. The commission shall elect a chairman from among its members.

(c) The commission—

(1) Shall maintain its principal office in the District of Columbia.

(2) Shall have an official seal which shall be officially noticed.

(3) May accept the services of any person without compensation.

Salaries

Sec. 2. Each appointed commissioner shall receive compensation at the rate of $10,000 per annum, payable monthly, together with necessary traveling expenses and expenses incurred for subsistence or per diem allowance in lieu thereof, within the limitation prescribed by law, while away from his official residence in the performance of duties required by this act. The commissioners ex officio shall receive no additional compensation for their services as commissioners.

Personal and Expenditures

Sec. 3. The commission may (1) without regard to the civil service laws, appoint a chief engineer who shall receive a salary at the rate of $..... per annum, and (2) appoint, without regard to the civil service laws and, without regard to the classification act of 1923, fix the salaries of such technical assistants and experts and such other officers, employees, and agents, and make such expenditures (including expenditures for personal services and rent at the seat of government and elsewhere, for law books, books of reference, and periodicals, and for printing and binding), as may be necessary for the execution of the functions vested in the commission, and as may be provided for by the Congress from time to time. All expenditures of the commission shall be allowed and paid upon the presentation of itemized vouchers therefor approved by the chairman.

Highway Survey

Sec. 4. (a) The commission is authorized to make preliminary examinations and surveys with a view to the construction of a post road and military highway (hereinafter referred to as the "central highway") from a point on or near the Atlantic coast to a point on or near the Pacific coast (such points to be designated by the commission), such central highway to be as direct as practicable between such points, except where, in the judgment of the commission, physical conditions, excessive cost, or other reasons render deviation necessary.

(b) The right of way for such central highway shall be not less than five hundred feet in width, the highway to be located wherever most desirable on the right of way.

(c) No part of such central highway shall be located within any municipality having a population, as shown by the latest available census, of two thousand five hundred or more, except where the houses average within a distance of one mile more than two hundred feet apart.

(d) The commission may select as part of the route for the central highway any highway or portion thereof which has been constructed (or is under construction) by or in behalf of the Federal Government or a State or political subdivision thereof.

Report

Sec. 5. The commission shall submit to the Congress within two years after the passage of this act a preliminary report of the examinations and surveys, and may make from time to time such additional reports as the commission may deem advisable. As soon as practicable the commission shall submit to the Congress a final report together with an estimate of the total cost of the proposed central highway and a plan therefor in such detail as may be practicable.

Study and Report on Highways to Connect with Central Highway

Sec. 6. With a view to providing for a system of highways connecting with the central highway, the commission is authorized and directed to make a careful and thorough study of existing routes and highways, for such purpose making use of all available surveys and investigations heretofore made, and to make a complete report to Congress, on or before the date of the submission of the final report on the central highway, upon the advisability and practicability of providing for the construction of the following additional highways:

(1) A highway from a point on or near the northern boundary of the State of Maine following a route as direct as practicable to a point in the southern part of the State of Florida; (2) a highway from a point on or near the northern boundary of the State of Washington following a route as direct as practicable to a point in the southern part of the State of California; (3) a highway from such southern point in California through the Southern States to connect with the eastern seaboard highway; (4) a highway from a point on the central highway as near longitude 100 degrees as may be practicable, northwest to connect with the western seaboard highway in the State of Washington; and (5) a highway from a point on the central highway as near longitude 95 degrees as may be practicable, south to connect with the highway through the Southern States.

Appropriation

Sec. 7. There is hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, the sum of $5,000,000, to be available until expended for expenses incurred in the administration of the functions vested in the commission by this act.

Title II.—Federal Highway Corporation Organization

Sec. 201. Upon acceptance by act of Congress of the final report and plan of the commission submitted pursuant to section 5, the commission shall be deemed to be converted into a corporation which is hereby declared to be a Federal governmental instrumentality under the name of "The Federal Highway Corporation" (referred to in this act as the "corporation").

Sec. 202. (a) The Secretary of War, the Secretary of Agriculture, the Secretary of the Treasury, the Secretary of Commerce, and the Postmaster General, and the six appointed members of the commission in office at the time of such conversion shall constitute the board of directors of the corporation (referred to in this act as the "board"). Any vacancies in the office of an appointed director shall be filled in the same manner as the original appointments to the commission. Each appointed director shall receive from the corporation a salary of $10,000 per annum, together with necessary traveling expenses and expenses incurred for subsistence or per diem allowance in lieu thereof, within the limitations prescribed by law, while away from his official residence in the performance of duties required by this act. The Secretary of War, the Secretary of Agriculture, the Secretary of the Treasury, the Secretary of Commerce, and the Postmaster General shall receive no additional compensation for their services as directors. The board shall elect a chairman from among its members.

(b) The terms of office of the six appointed directors first taking office shall expire, as designated by the President at the time of the incorporation, two at the end of the third year, two at the end of the sixth year, and two at the end of the ninth year after the date of the incorporation. The terms of office of all successors shall expire nine years after the expiration of the terms for which their predecessors were appointed; but any member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed only for the unexpired term of his predecessor.

(c) The board shall meet at such times and places as the board may designate.

(d) Vacancies in the board shall not impair the power of the remaining directors to execute the functions of the board. Six directors shall constitute a quorum for the transaction of the business of the corporation.

(e) The board shall direct the exercise of all the functions of the corporation.

Capital Stock

Sec. 302. The authorized capital stock of the corporation shall be such amount as Congress fixes in the act accepting the report and plan of the commission submitted pursuant to section 5, and all of such amount is hereby subscribed by the United States. Such subscription shall be paid by the Secretary of the Treasury, within appropriations made therefor, in amounts of $5,000,000 or multiples thereof, upon call from time to time by the corporation, and after thirty days' notice of each call to the Secretary of the Treasury. Upon any such payment a receipt therefor shall be issued by the corporation to the

United States and delivered to the Secretary of the Treasury, and shall be evidence of the stock ownership of the United States.

Issuance of Securities

Sec. 204. The corporation may borrow money and issue its notes, bonds, or other evidence of indebtedness therefor, except that the corporation shall not have power to issue or obligate itself in an amount of notes, bonds, or other evidences of indebtedness outstanding at any times in excess of 75 per centum of the value, as determined from time to time by the Secretary of the Treasury, of the real estate comprising the right of way for the central highway. The rate of interest, the maturity, and the other terms of such notes, bonds, or other evidence of indebtedness, and the security therefor, shall be determined by the corporation.

Liability of the United States

Sec. 205. The United States shall assume no liability, directly or indirectly, for any notes, bonds or other evidences of indebtedness issued by the corporation, and all such evidences of indebtedness shall so state on their face.

Taxation

Sec. 206. The notes, bonds, and other evidences of indebtedness of the corporation, and income derived in respect thereof, and the corporation, its income and property, shall not be exempt from taxation by the United Stntes, but shall be exempt from taxation by a State or political subdivision thereof.

General Powers of Corporation

Sec. 207. The corporation—

(a) Shall have perpetual succession in its corporate name.

(b) May sue and be sued in its corporate name.

(c) May adopt a corporate seal, which shall be judicially noticed, and may alter it at pleasure.

(d) May make contracts.

(e) May acquire, hold for any lawful purpose, and dispose of property; except that the corporation shall not dispose of any part of the right of way of the central highwny except by lease as herein provided.

(f) May appoint, fix the compensation of, and remove, without prejudice to contract rights, such officers, employees, and agents as are necessary for the conduct of the affairs of the corporation. Such employees and agents may be either individuals, partnerships, corporations, or associations. Each officer, employee, or agent responsible for the handling of money or other property of the corporation shall give bond in such amount, with such penalties and upon such terms as the corporation may determine.

(g) May adopt, amend, and repeal by-laws.

(h) Shall have such powers not specifically denied by law as are necessary and proper to the exercise of the functions vested in it by this act.

Offices

Sec. 208. The corporation shall maintain its principal office in the District of Columbia and may establish such agencies or branch offices at such places as it finds advisable. The corporation shall be held an inhabitant and resident of the District of Columbia and of each State in which it is doing business, within the meaning of laws of the United States relating to venue of civil suits.

Books

Sec. 209. The corporation shall keep, at its principal office in the custody of the board, correct books, showing the original minutes of the directors' meetings, and showing the accounts of the corporation's business transactions. The books shall be kept in such form and shall be open to inspection to such persons and at such times as the corporation may prescribe.

Audit

Sec. 210. The books and accounts of the corporation shall be audited at least once every year by the General Accounting Office. The report of the auditors shall be included by the corporation in its annual report to the Congress.

Report

Sec. 211. The corporation shall make an annual report to Congress at the beginning of each regular session containing a statement of the operations of the corporation during the preceding fiscal year.

Special Powers of the Corporation

Sec. 212. The corporation is authorized—

(a) To establish, construct, maintain, improve, and regulate the central highway (including tunnels, bridges, drainage structures, signs, guardrails, and protective structures in connection with the highway) in accordance with the plan approved by the Congress in accordance with the provisions of section 201, and for such purpose to acquire by purchase, condemnation, donation, or otherwise any real estate or interest therein which it deems necessary.

(b) After the completion of the central highway to provide, in its discretion, for tourist camps on any part of the right of way not used for roadbed.

(c) After the completion of the central highway to provide, in its discretion, for the establishment, operation, and maintenance along the highway, subject to the requirements of the air commerce act of 1926, of emergency landing fields, light and other signal structures, radio directional finding facilities, radio and other electrical communication facilities, and other structures and facilities in the aid of air navigation approved by the Secretary of Commerce. The Secretary of Commerce shall designate the route of such highway as a civil airway whenever and to the extent that the Secretary of Commerce finds that such route is suitable for interstate and foreign air commerce. The air navigation facilities owned or operated by the corporation may be made available for public use under such conditions and to the same extent as air navigation facilities owned or operated by the United States.

(d) To lease, upon such terms and conditions as the corporation deems advisable, any part of the right of way of the central highway not used for roadbed. Each such lease shall contain a provision authorizing the corporation to readjust the rental charges of the property leased at the end of each ten years at least; but the lease shall be valid for the term stipulated therein subject to the condition that the lessee, after such readjustment, agrees to pay the rental charges so readjusted. In lieu of real-estate taxes, the corporation shall pay to the State and its political subdivisions empowered to collect real-estate taxes, in which the property leased is located, 10 per centum of all moneys received as rentals from property so located. The corporation shall distribute such amount to the State and its political subdivisions, in such proportions as the governor of such State determines and reports to the corporation to be just and equitable, based upon the distribution of real-estate taxes in such State under the laws thereof.

(e) To issue permits and licenses for openings into, crossings over and under, or the use of any portion of the right of way of the central highway for purposes not inconsistent with the provisions of this act. In each such case the permittee or licensee shall be required to make such payment as will be sufficient to compensate completely for any damage done, and the receipts therefrom shall be covered into the treasury of the corporation.

Character of Highway

Sec. 213. Except where such a plan is impracticable and unnecessary, the central highway shall be so constructed as to permit a two-way fast traffic for tourist and non-truck traffic, and a two-way traffic for trucks and heavy traffic. The width and number of the traffic lanes shall be fixed by the commission. In approving the types and width of construction, types of surface, and kinds of material, and the character of improvement, repair, and maintenance in each case, the corporation shall give consideration to the type and character which shall be best suited for each locality and to the probable character and extent of the future traffic.

Income from Operations of the Corporation

Sec. 214. (a) The income of the corporation after paying the expenses of operation and maintenance and improvement of the central highway and other property of the corporation shall be used—

(1) For the payment of interest upon any notes, bonds, or other evidences of indebtedness issued under the provisions of section 204 and for the retirement of such notes, bonds, or other evidences of indebtedness; and

(2) For the payment of interest upon bonds issued under the provisions of section 304 and for the retirement of such bonds from time to time as the condition of the treasury of the corporation permits.

(b) After all the notes, bonds, or other evidences of indebtedness described in paragraph (1) of subdivision (a) of this section, and the bonds described in paragraph (2) of subdivision (a) of this section have been retired, there shall be paid to every State which shall have donated land for the right of way, 75 per centum of the annual income of the corporation derived from leases on such donated property in such State.

Title III.—Miscellaneous Provisions

Cooperation with Executive Departments and Other Agencies

Sec. 301. (a) The commission and the corporation may, in cooperation with any Government establishment, avail themselves of the services and facilities of such Government establishment in order to avoid preventable expense or duplication of effort.

(b) The President may, by Executive order, direct any such Government establishment to furnish the commission or the corporation with such information and data pertaining to the functions of the commission or the corporation, respectively, as may be contained in the records of such Government establishment. The order of the President may provide such limitations as to the use of the information and data as he deems desirable.

(c) The commission and the corporation may cooperate with any State or department, agency, or political subdivision thereof, or with any person; and may construct, maintain, and operate any part of the central highway within any State, by or through the State highway department of such State or any State department, commission, board, or official having adequate powers and suitably equipped and organized to discharge to the satisfaction of the commission and corporation the duties herein required.

Appropriation of Public Lands

Sec. 302. (a) If the corporation determines that any part of the public lands or reservations of the United States is reasonably necessary for the right of way of the central highway or as a source of materials for the construction or maintenance of the highway, the corporation shall file with the head of the executive department supervising the administration of such lands or reservations a map showing the portion of such lands or reservations which it is desired to appropriate.

(b) If within a period of two months after such filing such officer shall not have certified to the corporation that the proposed appropriation of such land or materials is contrary to the public interest or inconsistent with the purposes for which such land or materials have been reserved, or shall have agreed to the appropriation and transfer under conditions which he deems necessary for the adequate protection and utilization of such lands or reservations, such land or materials may be appropriated for the purposes and subject to the conditions so specified.

(c) If at any time the need for any such land or materials for such purpose shall no longer exist, notice of the fact shall be given by the corporation, and such land or materials shall immediately revert to the control of the head of the executive department from which they have been appropriated.

Regulation of the Highway

Sec. 303. The corporation may prescribe and promulgate such regulations as it deems necessary for preserving and protecting the central highway and safeguarding traffic thereon; but nothing in this act shall affect the civil, criminal, or administrative jurisdiction of the several States over persons or property upon the highway, or the rights and duties of persons with respect to the use and enjoyment of the highway under the laws of the several States.

Issuance of Bonds

Sec. 304. (a) There is hereby authorized to be appropriated such sums as may be necessary to enable the Secretary of the Treasury to make payments upon the stock subscription when called by the corporation.

(b) In order to meet such payments, the Secretary of the Treasury, if he deems it advisable, may exercise the authority granted by the various Liberty bond acts and the Victory loan act, as amended and supplemented, to issue bonds, notes, and certificates of indebtedness of the United States, and any bond so issued shall be disregarded in computing the maximum amount of bonds authorized by section 1 of the second Liberty bond Act, as amended.

Applicability of Bridge Laws

Sec. 305. All bridges constructed under the provisions of this Act over navigable waters of the United States shall be subject to the provisions of section 9 of the act entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," approved March 3, 1899, the act entitled "An act to regulate the construction of bridges, over navigable waters," approved March 23, 1906, and any law amendatory of, supplementary to, or in substitution for such section or act, respectively.

Separability of Provisions

Sec. 306. If any provision of this act is declared unconstitutional or the application thereof to any person or circumstance is held invalid, the validity of the remainder of the act and the application of such provision to other persons and circumstances shall not be affected thereby.

Principle of and Experiences With the Gas Tax

Some of the Problems that Have Arisen in Its Administration

By WM. A. McATEE

Missouri State Inspector of Oils and President North American Gasoline Tax Association

MOTOR-VEHICLE taxes were conceived as a logical measure for the building and support of public roads. Natural horse-power was able to draw its vehicles in some fashion, regardless of intolerable roads. But if there were going to be automobiles, there would have to be better roads. The question of paying for them was the first one to be settled. What was more logical than to tax that type of vehicle that could not operate without them? Who was likely to raise less objection to road tax than the man who had to have a better road? Who could better afford the expense than the man who could afford to own an automobile?

That was the logic of the automobile tax, and it met with so little resistance it was soon apparent that anything pertaining to an automobile or its operation upon the highways would be a legitimate subject for road tax.

The Gas Tax Equitable.—This was purely a per capita tax on vehicles. This per capita was different for large and small cars, but, nevertheless, it was so much "per," and had all of the singularities of a poll tax. It did not conform to the principle of a road toll. It was too arbitrary. Taxing the power by which motor vehicles are operated had not then been thought of. After it was thought of, what a discovery! How it fitted the needs of the situation! How it automatically measured the use of the road by each user, according to what he has paid! It considered distance travelled and speed and weight of the vehicle. It aimed at equality. It struck close to the fundamentals in the principle of taxation—the fundamental that the taxpayer who bears the greatest burden of tax should receive the greatest benefit from it.

That a power tax, like that of gasoline, simplified the problem in serving every taxpayer in exact and just ratio to his tax outlay was clear. None of this had been true of the vehicle tax. The fairness of the gasoline tax has been so manifest that much criticism is now heard of the vehicle tax, and widespread dissatisfaction with it has developed. When the inevitable has fully come, there will be no vehicle tax.

But what of the power tax? It is difficult to imagine how the tax would have been applied to power had it been steam instead of gasoline.

New Problems—New Measures.—As long as the power in use remains uniformly gasoline, the fullest measure of equality in road benefits will be the result, but should steam or electric power be brought into use, there would arise other problems calling for new measures. Just how to tax these types of power when used upon the highways, presents another problem. If suddenly confronted with an emergency of that kind, it would illustrate the unsoundness of the per capita vehicle tax. No arbitrary figure could be set upon the steam-propelled or electrically driven vehicle that would be satisfactory to the operator, the state and that part of the public using gasoline power. As well might it be undertaken to fix a road tax per capita for the mules and horses which the farmer rides and drives upon the highways. One is as sound as the other.

If road toll is the basic principle of road tax, a system, perfect enough in its operation to collect tolls in proportion to the use made of the highway, is desirable. As long as one kind of power only is used on the highways, namely gasoline, this is a simple matter. But horse and mule power, steam power, internal combustive power and electric power are all considered practical, and all of these forms are used. Others also are possible.

It is evident, therefore, that, excellent as the principle of the gasoline tax is, it is not fool-proof against the illicit uses of the highways by other forms of power. Still, gasoline power is the only form that contributes to the construction and upkeep of roads.

It has been assumed that combustive power, having built and kept up the highways, owns them. But does it own them? If invention tomorrow brings forth a perfected battery that will revolutionize transportation, what shall then be done. It would hardly be right to legislate it off the highways. Neither would it be fair to let it run tax free and crowd gasoline power off the highways that have been built by its sole contribution. The new power must also pay its share. What shall be done in that case? No measurement by gallons could be made. Will it be necessary to resort to the speedometer? Shall the government own the speedometer on every vehicle and keep it under lock and seal? Certainly new and different means of determining the tax due from individuals will then be necessary.

Gas Tax Best Known Means.—But, for today, the gas tax is the best means known of measuring the use of the roads, provided all users will confine themselves to gasoline power. Automatically it takes care of all accounts relating to highway usage. We must deal with today's problems today. Good roads today depend upon adequate revenues. Whether we have adequate revenues depends upon some form of taxation that meets sufficient public favor to be possible, and that is feasible enough to be practical. These conditions are well met in the gasoline tax.

Like all other new laws, the gas tax statutes enacted by many of the states and provinces have undergone changes since they were originally adopted. This was certain to occur. Imperfect provisions were unavoidable in the original enactments. Man progresses by evolution. Out of his experience and better understanding comes better gasoline tax laws.

To avoid placing the weight of the burden upon a group of willing taxpayers and permitting another group—not so willing—to escape the gasoline tax, we do not find its operation so perfect. Its measure of justice in that respect is not so automatic as distance, speed and weight are in vehicle operation. This inequality will always assert itself unless something is done about it. The extent to which it will develop, if let alone, is surprising. The forms it will assume challenge human ingenuity. It is known as evasion. When one user of the highway evades his just and fair share of the tax required to build it and keep it up, another must pay more than his fair share. If he does not there can be no highway.

Evading the Gas Tax.—Evasion takes form in many ways. Partial reporting of tank-car shipments was common in the states during the early stages of gas-tax development. These omissions, first uncovered by checking up freight records, were soon abandoned. If the larger cities are all on the borders of states or provinces, evasion can easily take the form of bootlegging. This practice is usually conducted by illicit operators in tank-wagon business. Registered and licensed distributors will seldom attempt any deception. The rule is that when a distributor of motor fuels registers his intention of complying with the law, he will do so. It is equally true that the operator who does not register will invariably fail to comply with the law. The peddler who owns no stationary property and operates only a truck, sometimes borrowed, will bear watching. It is possible that a property owner—a station operator—will loan one of his trucks to an illicit operator and have his own

gas bootlegged in the other fellow's name, but this is an exceptional practice which rarely occurs.

Distributors of motor fuels, as a group, are as honorable as any other class of merchants, and 95 out of 100 will do the right thing by the state as readily as merchants will in other lines of business. There are many whose principles and ideals are as high and fine as can be found anywhere. There are hundreds of them in the state of Missouri upon whose good intentions at all times I can depend. These are not the men referred to when I speak of evaders. These men have always given the state their co-operation. They have also helped to find out the evader. Without their help, the task would be much more difficult for the state.

The Newcomer the Violator.—When the station owner has been overtaken in wrongdoing, it has usually been a case of the new arrival in the motor-fuel business. Well-established concerns who have acquired a vision of service are seldom guilty of intentional evasion. They know that it does not pay. They know that honesty is the best policy, even in the oil business. The new arrival does not invariably know that. He sometimes flits about the candle a bit. A slight singeing will probably cure him.

But the flame of the law must burn steadily, for no telling when a new arrival will fly in—one of those fellows who is too wise to get caught. No man who deliberately violates the law is wise. There will always be men without honor, shrewd in their conceits, who will ever hold the dollar above the value of honor, law and country, but there will always be men also who will hold honor, law and country above money, who will see to it that the dollar-man does not get away with his game.

Refunds on Gas Tax.—In their conceptions of equity, the framers of the gas-tax laws, in many states and provinces, have provided that taxes collected upon gasoline consumed in other uses than that of propelling motor vehicles upon the highways, shall be refunded to the consumers. Evasion of a different type is here found. Fuels purchased for farm machinery by 50-gal. drum lots is frequently used to operate motor cars upon the public roads, although refund of the tax is claimed. The gallonage figures are frequently erased from the sale tickets given by dealers to consumers, and other figures for more gallons written in place of them; deductions for shipments going out of the state are sometimes exaggerated; border cities having a municipal tax, but no effective means of enforcement, are cheated by truck deliveries into their corporate limits from outside the state, such sales being reported to the resident state and state tax paid there, in order to profit by the city tax.

This refund provision of the law is limited in a few states and provinces to gas consumed to restricted uses. For instance, South Carolina refunds the tax only on gas used in yachts owned by non-residents, and Nova Scotia refunds only to fishermen and farmers and for process (not power) manufacturing. But in nearly all cases, when refunds are provided by law, the refund applies to all uses except the propulsion of motor vehicles upon the public highways.

The North American Gasoline Tax Conference went on record at both of its national conventions in opposition to refunds of gas tax. The reasons for its action were three:

1. Refunds open the door to fraud.
2. Refunds are unfair.
3. It costs the state too much in administrative expense to refund the tax.

Refunds Open Door to Frauds.—Under the first head, it was found at the end of 1927 that there was such a wide range in the percentages of refunds to collections, that lack of efficient methods in handling refunds in many of the states was suggested. The range was from 1½ to 23 per cent. The average among the states was 6½ per cent. Experience has proven that if a searching investigation is not made in every case where there are surface indications of intention to claim larger refunds than applicants are entitled to, that it is soon considered easy to put claims through and a general raid upon the appropriation will soon be started. Officials in the State of Arkansas were indicted last year in connection with refund frauds.

Distributors have found a way to use the refund in building up business among tax-exempt consumers. They require large quantities of refund application forms and have each customer sign several in blank. These they hold in the office, and at the end of the month have an office notary fill them out and send them to the Department. Uses listed are guessed at by the notary. He has customers saying they were operating farm tractors who never lived on a farm. Sometimes they didn't bother to have customers sign the applications, but the office notary or driver signed the customer's name and took his affidavit without seeing him. With a mad desire to get at the appropriation, letters were written demanding why the administrative officer insisted upon the inconvenience of legal requirements. Notaries were found in banks doing that kind of work. An order was made to refuse the work of all notaries found guilty of such practices, and to return all applications bearing acknowledgments executed by them.

Gasoline bought by consumers for temporary storage, upon which refunds were claimed and non-taxable uses listed, was found to have been used in motor vehicles on the highways.

Refunds Unfair.—Second Head: The North American Gasoline Tax Conference thought refunds were unfair because they are discriminatory. Taxes are returned to taxpayers by means of refunds on the ground that such taxpayers have not received any benefits from roads built with the tax. But that was a false premise. All taxpayers receive benefits from good roads. Farmers have good markets brought to their doors, their land values are enhanced and they actually use the roads with their wagons and teams free of cost. If enhancement of land values is not a good reason for taxing gasoline used on the farm in building a highway near it, the principle of taxing a town lot to pave a street on that account is also wrong. The owner of the lot must make use of the street before he shall be taxed to pave it. It is an unheard of precedent to refund taxes.

Cheaper, quicker, more rapid shipping facilities are the advantages the good roads bring to the manufacturer, and provide easier distribution and a larger market for his products. It is no injustice to him to pay the road tax on his gasoline consumption. It is only fair to the transportation company which bears the whole road burden over which it hauls his products.

A highly developed country, industrially and agriculturally, is the result of road building. This has multiplied the business of the railroads, and they can afford to pay the road tax on their gasoline consumption. It is not fair to exempt them and make the transportation company, which assembles and distributes freight to and from their depots, bear the entire burden of providing highway arteries through which flows the stream of their business.

If the only benefit of a highway is derived from driving a gasoline vehicle upon it, and no one shall be taxed to build and maintain it except those making such use of it, then it follows that the only benefit that can be derived from the public schools is to have children in school, and school tax should be refunded to any taxpayer who has not. If the schools have their immaterial community value, the roads have their material community value.

Cost of Refunds Cost Too High.—Third Head: Two administrative costs are involved in refunds—first, the expense of collecting the tax, and second, the expense of refunding it. Since the beneficiary of the refund gets all of his money back, both of these bills are paid by the vehicle operator. He puts up his road tax and out of it pays the entire cost of collection of all tax received—both his own and the other fellow's. Then he pays the cost of refunding the other fellow's. Then he pays the road bills. Isn't it a little one-sided to give back to one man all that he pays in, and make another man pay the expense of the process, pay the road bills, and stand to be gouged also by the favored party?

The average cost in collecting this tax is ½ of 1 per cent. It costs 5 to 10

per cent to refund it to the exempt classes. Do you wonder why the state requires the exempt classes to pay the tax and then refunds it to them? The reason is that the question of exemption must head up in one authority. If the authority were delegated to 10,000 dealers, there would be 10,000 interpretations of the law, and it would then cost the state in taxes lost, perhaps, half of all it collects under the refund system.

No, it is better to make the automobile-owner pay all the bills of collection, refunding and road-building, and centralize the authority for judging exemptions in one head, but it would be best to require every class to pay its share and refund no tax to anybody. That is the position of the North American Gasoline Tax Conference.

All of your nine provinces, and 46 states of the Union, now have a gasoline tax. It would have been 47 states had not Illinois lost its law in the constitutional test before the State Supreme Court. Very few of these codes have made any use of the gasoline tax except to build and maintain roads or pay road bonds. I think that it is a principle that is considered fundamental that revenues arising from gas tax shall be applied only to that purpose. It is unrelated to any other, and taxpayers will resent the unfair expenditure of their money.

Acknowledgment. — The foregoing paper was presented Sept. 26 at the 15th Annual Convention of the Canadian Good Roads Association.

Highways Now Being Built to Care for Traffic Growth

"Traffic congestion, until recently a serious problem only in the cities, has moved outward and now imposes its time-consuming delays and menace to life and property upon the principal highways near large metropolitan centers," says Thomas H. MacDonald, Chief of the Bureau of Public Roads of the United States Department of Agriculture.

"Such congestion points especially to the necessity for acquiring rights of way of ample width to allow for future widening or the making of definite provision for future acquisition as needed. It also demands that highways be designed for safe use at higher speeds, and that arterial routes be improved with the service of the entire route in mind. In metropolitan areas congestion has emphasized the urgency of grade-crossing elimination, wider pavements, and the building of relief and by-pass highways."

Taken as a whole traffic on the roads of the United States has doubled in less than five years, and in some States it is still increasing at an even more rapid rate. The design of motor vehicles has been so perfected that greater speed can be attained without increasing the hazard so far as the vehicles themselves are concerned. Development of common-carrier busses is still in its infancy.

To care for the ever-growing and changing traffic, and to make a wise allotment of available funds, the Federal Government and State highway departments have found that some index of future highway needs is necessary as a working basis. Such an index they have acquired in their studies on the flow and growth of highway traffic in various sections of the country. From these studies, future needs are anticipated in re-establishing the location and in planning the structure of highways. Also a more efficient expenditure of funds is possible.

Pan-American Highway Conference to Be Held in Brazil

The Pan-American Highway Congress which will be held in Rio de Janeiro next year is attracting much attention on the part of highway engineers and builders of road machinery.

President Washington Luis of Brazil is determined to open up the vast resources of his country by a net work of modern roads. Two trunk lines, totalling about 400 miles, have recently been completed. This is but the beginning of an extensive road building program, conducted under Federal aid and supervision and supported by a special tax levied on gasoline and automobiles.

This Highway program in Brazil will greatly increase the opportunity for the sale of American automotive and road building machinery, and also should create additional markets for other American products in the new out-lying sections that will be opened up in this great South American Republic.

For this reason the forthcoming Pan-American Highway Congress carries a great significance to all American industry in addition to those only interested in highway construction.

Peru Establishes Government Traffic Department.—A decree of Aug. 10, 1928, establishes a Federal Traffic Section in the Bureau of Transportation of the Ministry of Fomento (Public Works). The new office is charged with drawing up a plan of general traffic regulations for the entire country, of controlling the application of the plan once approved and of all measures conducive to the greatest public safety on the roads and highways, which pass through different municipal jurisdictions. An American traffic expert who has been serving the municipality of Lima in a similar capacity for the past ten months has been placed in charge of the new office.

Better Concrete

The Bureau of Public Roads, United States Department of Agriculture, has begun a drive for better concrete. Declaring that the results of research and tests conducted by the bureau and other agencies in recent years now show that it is possible by applying the theories developed by the experiments to produce concrete of much greater uniformity and increased strength, Chief Thos. H. MacDonald has laid down definite principles to obtain these results.

The bureau's principles, the application of which it will actively encourage, are stated in recent instructions issued by Mr. MacDonald to engineers of the bureau for their guidance in approving future concrete road projects submitted by the states for construction with Federal Aid.

Concisely stated, the principles are:

1. The abandonment of volumetric proportioning of aggregates and the adoption of proportioning by weight as standard practice. Inundation will be recognized as a permissible alternate method for fine aggregate, but weighing is preferred.
2. Maintenance of the lowest water-cement ratio which, with the particular type, grading, and proportions of aggregate used, and the methods of finishing employed, will produce a workable, dense, and uniform concrete.
3. The scientific grading of coarse aggregate by combination of separated sizes in each batch in the proportions which will produce the maximum practicable density.
4. The abandonment of hand finishing methods in favor of machine finishing.

The state specifications previously approved by the bureau for Federal Aid concrete pavements provide for certain standard proportions of cement, and fine and coarse aggregate. As a result of recent tests the bureau is now convinced that better and more economical concrete may be produced in some instances by increasing the proportion of coarse aggregate previously specified, providing the density and uniformity of the mix are not impaired. It has therefore announced that where adequate engineering control is assured, the coarse aggregate proportions previously approved may be increased if, by combination of separated sizes in each batch, a well graded aggregate is produced and the resulting concrete is dense and uniform, workable by the methods of finishing employed, and of a quality at least equal to that produced by the approved standard mix.

Where concrete in which the proportion of coarse aggregate is increased is placed in competition with concrete proportioned in accordance with the previously approved specifications, the bureau will require that the type of coarse aggregate and the mortar mix in each shall be identical, and that the maximum limit of water-cement ratio shall govern.

New Books

Widening and Superelevation of Roadway Curves; by John H. Fletcher, C. E., Topeka, Kansas. Published by the author. First Edition, 63 pp., 4 by 6½ in., flex. binding; price, $2.50.

The transition curve used in these tables is the Talbot Railway Transition Spiral. Tables are printed for 16, 18, 20, 22 and 24-foot roadways. The tables and explanatory matter cover both inside and outside widening.

Estimating Building Lots; by William Arthur; Scientific Book Corporation, 15 East 26th St., New York City, publishers; Third Edition, revised and enlarged, 233 pp., 4½ by 7 in., flex. binding; price, $2.00.

This is a book written especially for tradesmen. It deals with data covering construction of houses, barns, store buildings, etc. Tables are prepared on a given uniform rate per hour for wages of mechanics and laborers. Both material prices and labor costs are included in the detailed cost analyses.

Patent Law for the Inventor and Executive; by H. A. Toulmin, Jr., Patent lawyer; published by Harper and Brothers, 49 East 33rd St., New York City; First Edition, 288 pp., 5⅝ by 7⅞ in., cloth binding; price, $4.00.

This work contains facts and practical examples on all problems of patent law. The protection of the inventor's new ideas, the proper relation of the corporation to those who work in its research laboratories, the procedure of procuring patents, the ways of stimulating new inventions—these are all discussed in a practical and helpful fashion. Typical chapter headings are "How to Get a Valid Patent"; "Who Owns the Invention—Employer or Employee?"; "How to Avoid Patent Infringement"; "What Are Patents Worth?"; etc. The book is written in very readable style.

Elements of Highway Engineering; by Blanchard and Morrison, Consulting Engineer and Traffic Control Consultant and Professor of Highway Engineering and Highway Transport, University of Michigan, respectively; John Wiley and Sons, Inc., New York City, publishers; Second Edition, 350 pp., 5⅞ by 9 in., cloth binding; price, $3.75.

Highway engineering practice has undergone such great changes since the publication of the first edition that the present volume, the author states, represents more of a rewriting than a revision.

The book is a general treatment of the subject and does not delve into the details of the practice. As the title indicates, the subject matter is just a general discussion of the elements of the practice, science and art of highway design, construction and maintenance.

Water Purification; by Joseph W. Ellms, Engineer of the Water Purification and Sewage Disposal Division, Dept. of Pub. Wks., Cleveland, Ohio; McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City, publishers; Second Edition, 594 pp., 5¾ by 9 in., cloth binding; price, $7.00.

This book discusses the problems of purification by presentation of actual cases and method of treatment. It contains a great amount of detail matter, both qualitative and quantitative. Designs of various filter plants and water works plants are shown to bring out the points discussed in the various chapters.

The text is well supported by quotations from reports of experimental work and operation. Some of the data are rather antiquated and should have been replaced by more recent information.

The author stayed within the confines of his subject and treated it in a manner good for reference work as well as class study.

Safety and Production; a report by the American Engineering Council; Harper and Bros., New York City, publishers; First Edition, 414 pp., 6 by 9⅛ in., cloth binding; price, ?.?.

This volume will be found to be a printed report of the Committee on Safety and Production of the American Engineering Council. The study was made at the request and with the financial assistance of the National Bureau of Casualty and Surety Underwriters. The report answers such question as:

1. Have industrial accidents increased in frequency or in severity in recent years?

2. Can industrial accidents be better controlled under modern conditions of production; and if so, how?

3. Is the safest factory the most efficient factory?

The book contains many charts and tables of commodity or factory production rates, frequency rates, severity rates, etc. A statement of the problem, findings of the committee and digest of the report constitute Part I of the book.

Highway Engineering; by John H. Bateman, Professor of Highway Engineering, Louisiana State University; John Wiley and Sons, New York, publishers; First Edition, 418 pp., 5¾ by 9 in., cloth binding.

Here is a logical presentation of the elements of highway engineering, not detailed as a reference work, but addressed more to the student of highway engineering problems. Present practice in the primary divisions is presented in a manner to bring out the fundamental principles involved. The text is supported throughout with citations from responsible and authoritative sources. A set of questions at the end of each chapter will assist the reader in applying the information contained therein.

The author lays no claim to being a specialist in all of the branches of highway engineering, and therefor this book, represents a compilation of data, descriptions of practice, and opinions from many sources. It is evident, however, that he has been, at some time, on actual field construction work.

Plumbing Design; by A. L. Nugey, A.S.M.E.; The Chemical Publishing Co., Easton, Pa., publishers; First Edition, 351 pp., 6 by 9 in., cloth binding.

This is a collection of data and information on the various divisions of plumbing work. Gas, water, sewer, and appurtenance designs, hookups and layouts are shown and discussed. The text contains considerable detail matter, tables and charts.

Modern Roadmaking; by Harold Bradley and C. C. Hancock, both M. I. Struct. E., England; published by The Contractors Record, Ltd., 329 High Holborn, W. C., London; First Edition, 312 pp., 6 by 9⅝ in., cloth binding, price, 15s net.

The following quotation from a review of this book by an engineer in Great Britain, Mr. A. C. Hughes, B. Sc., A. M. Inst. C. E., will probably present the case better than we could do:

"It is intensely practical and covers ground which as far as my knowledge goes has not been previously included in any English book on the subject. As the authors point out, it has been written to supplement existing treatises and a student will need to turn elsewhere to obtain some of the theoretical considerations in the design of roads, but his education would not be complete until he has thoroughly digested the contents of this book which bears unmistakably the stamp of practical knowledge of the problems of the road maker and the methods of overcoming them."

The chapter on concrete road construction is not as complete as modern practice demands. Another chapter which would have been welcomed in this treatise is a discussion of the economics of highway construction.

Bituminous types of highway construction are discussed quite thoroughly.

Parks—A Manual of Municipal and County Parks; edited by L. H. Weir; A. S. Barnes and Co., New York, publishers; 2 volumes, First Edition, Vol. I, pp. 1-506; Vol. II, pp. 507-1,036; 7½ by 10½ in., cloth binding; price, $15.00 net.

These two volumes were compiled as a result of a nation-wide study of municipal and county parks conducted by the Playground and Recreation Association of America in co-operation with the American Institute of Park Executives at the request of the National Conference on Outdoor Recreation. The books discuss the general planning, financing, elements of design, construction, administrative control, maintenance and divisions of park systems. The books are a general clearing house of ideas on parks and playgrounds as proposed and constructed in the United States.

Reports, New and Revised Publications

Stevens Master Specifications; by Frank B. Stevens, Jr., Assoc. M. A. S. C. E. Stevens Master Specifications, Inc., Chicago, Ill., publishers. 40 sections, page 8½ by 11 in., hard cloth binding, loose leaf.

This is a compilation of standardized specifications on building construction made open enough to encourage competitive bidding. It contains advertising in some of the sections which pertains to material in that section. The purpose of the publication is to present open-competitive specifications for use of architects and builders.

DISTRIBUTOR NEWS

The Distributor's Department in the Gillette Construction Group

Merry Christmas

With the December issue of Distributor News, we extend the season's greetings to our readers. May your Christmas stockings be filled with orders for every type of highway equipment now in your warehouses and catalogs.

We hope that this new department of our magazines is making friends among our readers and that you are beginning to look forward with pleasure to receiving it. Take advantage of this department, which is at your service. Create in it a lively reader interest, by sending in reports of what is happening in your field. Warehouse stories, remodeling, seasonal plans, organization changes, business trips,—these are all human interest topics and we all like to read about them.

Pictures add to the interest of a story so send along your cuts or photographs of warehouse plants or officials of your company. Do not be afraid of writing often. We are glad to hear from you and will use your contributions as far as our space permits. Address all communications to Editor, Distributor News, Gillette Publishing Company, 221 East 20th Street, Chicago.

Hunter Machinery Company Reports a $1,000,000 Year in Michigan

THE Hunter Machinery Company, large distributors of construction equipment, incorporated under the laws of both Michigan and Wisconsin, announce 1928 to be one of the most successful years in their history.

The Michigan company's new plant at Detroit met with such immediate success that the sales volume for the first year is reported as considerably over $1,000,000. Following the successful results of the opening of the Grand Rapids office in 1926, the capital of the Michigan corporation was increased to a fully paid up capital of $250,000, in order to accommodate the growing business.

Mr. M. R. Hunter, president of the company, reports that the Detroit plant has been doubled and additional ground purchased to the south of the main building. The display room has a 100-ft. frontage on Waterman Ave., and is two stories high, in order to take care of Northwest cranes, Rex pavers and other equipment carried in stock. The plant includes a large modern parts room, and at the rear of the building there is a two-story shop of fireproof construction. Both buildings are of brick, concrete and steel. Mr. Hunter states that additional ground has been secured at Grand Rapids, doubling the holdings of that plant, and an additional building is under construction there.

Announcement is made that Mr. Alex. G. C. Duncan has joined the sales force of the Detroit plant. Mr. Duncan for the past twelve years has been engaged in the contracting business in Philadelphia, specializing in paving.

The officers of the Michigan corporation of the Hunter Machinery Company are: Morton R. Hunter, president; B. E. Uebele, vice-president and treasurer; T. G. Abrams, vice-president in charge of sales; R. A. Arndt, assistant treasurer, and M. P. Allen, secretary.

The Wisconsin corporation announces many additions and improvements in the plant at Milwaukee. It is stated that the 1928 sales for the Wisconsin company will exceed $1,000,000. The sales record of the Hunter Machinery Company places it in the front ranks as manufacturers' distributors, and equipment from the following plants is handled:

Atlas Motor Mixers.
Bates Valve Bag Co.
Blaw Knox Company.
Chain Belt Company.
Dure Pumps and Saw Rigs.
Cleveland Wheelbarrow & Mfg. Co.
Northwest Engineering Co.
Pulsometer Steam Pump Co.
Reynolds Portable Furnace Co.
Roos-Meyer Hecht Co.
Rowe Mfg. Company.
Sasgen Derrick Co.
Clyde Iron Works Sales Co.
Conneaut Shovel Company.
C. D. Edwards Mfg. Co.
A. W. French & Co.
Homelite Corporation.
A. Leschen Sons Rope Co.
C. A. Londelius & Co.
M. & M. Wire Clamp Co.
Mulconroy Company.
Sauerman Bros., Inc.
Sullivan Machinery Co.
Syntron Company.
Templeton, Kenly & Co.
Toledo Pressed Steel Co.
Western Wheeled Scraper Co.

Truck-Tractor Equipment Co. Takes Over More Territory

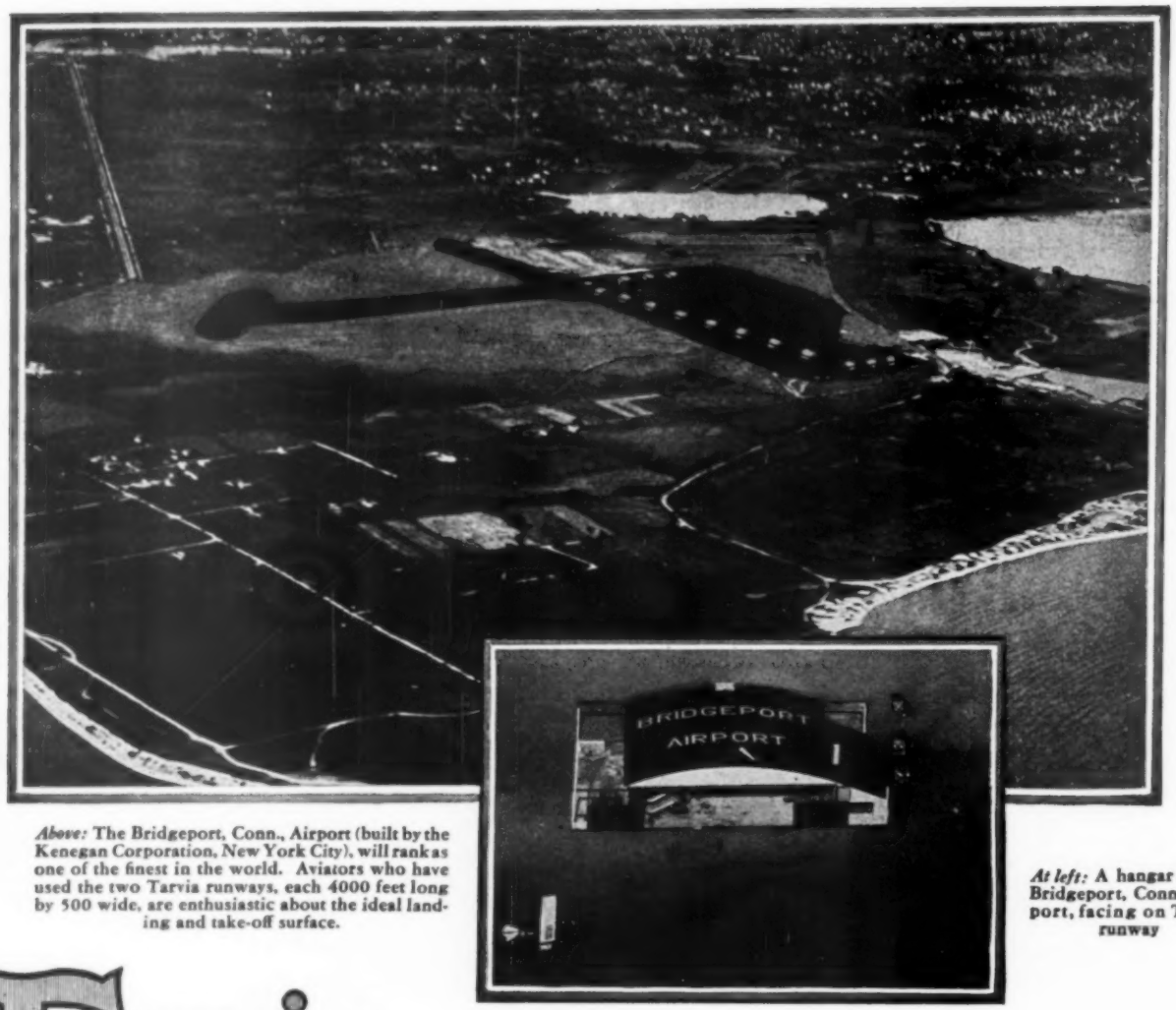
The Truck-Tractor Equipment Co., 460 Neilston St., Columbus, O., well known tractor and equipment distributors, have recently enlarged their territory considerably and increased their sales activities.

In addition to the central Ohio territory, these distributors are now also covering the Cincinnati district, almost all of West Virginia, and parts of Kentucky, Maryland and Indiana. They have recently arranged with the International Harvester Co. for the distribution of McCormick-Deering Industrial tractors in these territories, and with the Trackson Company for the handling of Trackson full-crawlers, shovels, loaders, cranes, etc., which are adapted to combination with the McCormick-Deering.

The picture shows officials of the Truck-Tractor Equipment Co. testing out and admiring the Model DH Trackson McCormick-Deering unit, which has had a good sale in their territory.

It is the policy of these distributors not to sell competing lines; instead they concentrate on the sale of a few lines for their territory. The contracting, highway, and industrial fields are their most important sales outlets.

Testing Out Model DH Trackson McCormick-Deering. From Left to Right: F. M. Duffy, General Manager; L. E. Andrews, Trackson Representative; Elmer E. Schatz, President Truck-Tractor Co.; R. K. Gilson, Sales Manager



Above: The Bridgeport, Conn., Airport (built by the Kenegan Corporation, New York City), will rank as one of the finest in the world. Aviators who have used the two Tarvia runways, each 4000 feet long by 500 wide, are enthusiastic about the ideal landing and take-off surface.

At left: A hangar of the Bridgeport, Conn., Airport, facing on Tarvia runway

Tarvia

PATHWAYS *into the* SKY

SINCE 1903, Barrett Company engineers have specialized in road construction and maintenance in every section of the country. These men know how to utilize local materials—how to cope with local difficulties. They have made possible the tremendous mileage of Tarvia roads.

Now—a new field. Take advantage of the Tarvia man's vast fund of accumulated knowledge. Let him help you with this new problem.

Tarvia runways are resilient. They are economical—may be constructed largely of local materials. They are mudless, dustless and skid-safe.

For further information, get in touch with the Tarvia man at our nearest branch.

The Barrett Company

New York	Chicago	Minneapolis	Cleveland	Philadelphia	Birmingham	Boston
St. Louis	Salt Lake City	Syracuse	Providence	Buffalo	Bethlehem	Kansas City
Detroit	Milwaukee	Baltimore	Toledo	Cincinnati	Lebanon	Columbus
Youngstown						Rochester

In Canada:

THE BARRETT COMPANY, Limited: Montreal, Toronto, Winnipeg, Vancouver

Yes—we would like you to mention ROADS AND STREETS.

Milwaukee Corrugating Co. Acquires Eastern Plant and Distributing Warehouse

Announcement has just been made of the purchase of the Eller Manufacturing Company of Canton, Ohio, by the Milwaukee Corrugating Company. The purchase becomes effective January 1, 1929.

According to the announcement the Eller Manufacturing Company will continue to operate as formerly, but much new machinery will be installed and many new lines will be added. Metal lath, corner beads, channels, road strips, etc., are mentioned as part of the increased output.

The property of the Eller Manufacturing Company consists of 7½ acres in the manufacturing district of Canton, on the main line of the Pennsylvania Railroad. It occupies a modern building approximately 280 ft. x 300 ft.

In acquiring this manufacturing plant and distributing warehouse, the Milwaukee Corrugating Company will be in a position to secure a national distribution of their products, and better facilities for handling their foreign business.

American Steel & Wire Co. Appoints New Advertising Manager

Announcement has just been received of the appointment of Mr. William H. Cordes, as manager of the Advertising Department of the American Steel & Wire Company, Chicago. For fifteen years Mr. Cordes has been associated with this department, for the past six years serving as assistant advertising manager under Mr. Binley B. Ayers. Since the recent retirement of Mr. Ayers the responsibilities of the advertising department have been in charge of Mr. Cordes, and it is in recognition of the splendid manner in which he has handled the duties involved that this announcement has been made by the company.

Mr. Cordes was educated in the public schools of Chicago and Northwestern University and in addition took a course in business management. Mr. D. A. Merriman is vice-president and general manager of sales, and Mr. J. S. Keefe, president of the American Steel & Wire Company.

Personal Mention

Announcement has been received of the resignation of Mr. A. G. Bissell from the Westinghouse Electric & Manufacturing Company, East Pittsburgh, where he served as a welding engineer. Mr. Bissell has gone to the Pacific Coast where he will engage in the industrial field as an independent consultant in arc welding engineering.

Since his graduation from the University of Washington the arc welding industry has engaged Mr. Bissell's entire time. He holds both a B. S. and C. E. degree. Before entering the employ of Westinghouse in 1923, Mr. Bissell was arc welding metallurgist, U. S. Navy Yard, Puget Sound, Washington; arc welding engineer, Boering Airplane Company, Seattle, Washington, and superintendent and engineer of the Arc-Weld Furnace Company, Seattle.

A Girl in a Glass Case

The young lady in the illustration, is Miss Virginia Wood of South Bend, Indiana. She is the daughter of Mr. L. A. S. Wood, manager of the street lighting section of Westinghouse Electric and Manufacturing Company.

This globe will soon be installed in the down-town lighting system of St. Louis. It was produced at the South Bend, Indiana, works of the Westinghouse Electric and Manufacturing Company, and is a Giant Paragon. It is four inches taller than those used on the famous State Street, Chicago.

An idea as to its mammoth size can be gained from the fact that it is large enough to all but envelope Miss Wood.

Miss Virginia Wood, Daughter of Official of South Bend Branch of Westinghouse Electric & Mfg. Co., Standing in World's Largest Street Lighting Globe

Member of Universal Crane Co. Honored by National Traffic Association

Col. I. C. Moller, Universal Crane Company, Cleveland, has recently been made an honorary vice-president of the National Highway Traffic Association.

As an aid to the heavy burden laid upon the highways of the nation, the National Highway Traffic Association was formed in 1918 to promote efficiency and regulation of their traffic and transport problems.

Representatives from every group of citizens were drawn into the membership. Traffic and highway engineers, judges, police magistrates, automobile club executives, owners of truck and bus fleets, manufacturers of trucks, buses and highway machinery and materials, executives and members of chambers of commerce and officers of the United States Army.

Mr. Arthur H. Blanchard has served as president of the Association since its beginning. Mr. Blanchard for many years has served the departments of highway engineering and transport at Columbia University and University of Michigan, and is a leading traffic control and transport consultant.

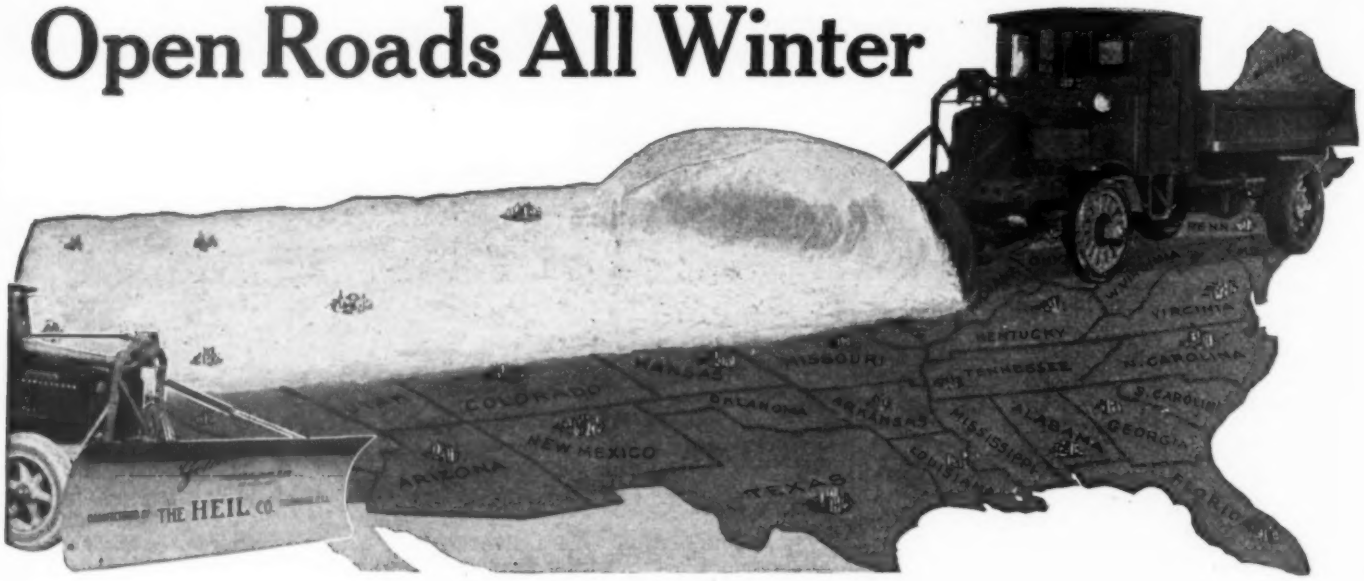
Young Radiator Co. Reports Large Sales

The prosperity, of which the newspapers of the country write about daily, is doing its share in the engineering field, judging from the splendid reports received by this publication. The latest report is one from the Young Radiator Company of Racine, Wisconsin.

Mr. J. J. Hilt, sales manager for this company states that the sales of November, 1928, are 400 per cent over the sales for the same month of last year, and that unfilled orders extending into the next six months guarantee operations on a greatly increased basis. The bright outlook for this company extends well into the future for Mr. Hilt goes on to say: "During the past six months we have received important signed contracts for manufacture of radiators and heaters from a number of major manufacturers of tractors, trucks, compressors, etc., that continue through 1929, which in addition to the contracts pending will necessitate operating at a much increased schedule through the balance of this year and the first six months of 1929."

The Young Radiator Company's product is a heavy-duty, sturdy radiator for all types of road and construction equipment.

Open Roads All Winter



With Gettelman Hi-Speed Snow Plows

The Plow Blade is offset so as to clear the way for the truck wheels.

Highway commissioners, municipal officials and contractors will find the Gettelman Hi-Speed Snow Plow ideal equipment for solving the highway and street snow removal problem this winter. It is the lightest, fastest and strongest trip blade plow on the market. The City of Milwaukee and Milwaukee County have standardized on Gettelman Hi-Speed Snow Plow equipment, having found through actual experience that the Gettelman plow shows maximum accomplishment with minimum power, is light in weight, has keen cutting ability and is sturdily built to withstand unusual service.

The Gettelman Hi-Speed Snow Plow will operate in dry snow at a speed up to 35 miles per hour. The plow may be easily and quickly installed, and later mounted or removed at will, on any truck of two tons capacity or larger. The scraper blade is 38 inches high and is made in nine and ten-foot lengths.

Mail the coupon below, today, for complete information.

THE HEIL CO.

1138-1150 Montana Avenue Milwaukee, Wisconsin

The Heil Co.,
1138-1150 Montana Avenue, Milwaukee, Wis.

Please send me your Bulletin 183 which contains complete information about the Gettelman Hi-Speed Snow Plow.

Name_____

Firm Name_____

Address_____

The Gettelman Snow Plow Scrapes clean. Here it is in operation on a rough brick pavement.

New Appointments

The Universal Portland Cement Company, a subsidiary of the United States Steel Corporation, announces through their general sales manager, Mr. F. L. Stone, the following new appointments:

Mr. R. H. Hoy, former division sales manager, as sales manager at Pittsburgh; Mr. N. A. Kelly, former division sales manager, sales manager at New York; J. K. Hallock, former division sales manager, assistant sales manager at Pittsburgh; Mr. F. A. Brine, division sales manager, Pittsburgh, succeeding Mr. Hoy; Mr. W. H. McDowell, former sales agent, Cleveland, division sales manager at Pittsburgh.

In making this announcement, Mr. Stone states that all the new appointees have been with the Universal Company for many years, and that their long experience and familiarity with the work will assure a continuance of the standards and service for which this company is known.

Mr. Samuel C. Rebman, who has represented the Sweet's Steel Company in the capacity of the District Sales Manager in the Pennsylvania anthracite coal fields, is now transferred in the capacity of sales manager to the branch office of this company located at 274 Madison Avenue, New York City.

Mr. Hugh G. Daley, formerly with the Carnegie Steel Company has been appointed sales manager in charge of the Pennsylvania anthracite coal fields, of Sweet's Steel Company. He will hereafter be located in the company's branch office 733-734 Land Title Building, Philadelphia, Pa.

Announcement has just been received of the appointment of the New England Implement Company, 22 Garden Street, Worcester, Massachusetts, by the Erie Machine Shops, Erie, Pa., as distributors for the New England territory.

W. A. Riddell Company Opens Branch at Little Rock, Arkansas

On November first a branch of the W. A. Riddell Company was established at North Little Rock, Ark. Mr. O. E. Tapley has been appointed branch manager. Mr. Tapley was formerly connected with the Arkansas State Highway Department, and is well known among road men, contractors and highway officials throughout the state.

The W. A. Riddell Company manufacture the well known WARCO line of road machinery, and a full line of their products will be carried by the North Little Rock branch. Graders, road rollers, wheeled scoops, full and semi-crawlers, and crawlerized tractors will will be delivered direct from the warehouse at North Little Rock. Orders for parts will also be filled by the branch.

Millers Falls Line of Portable Electric Tools Now Handled by Ryerson

Joseph T. Ryerson & Sons, Inc., with plants at Chicago, Milwaukee, St. Louis, Cleveland, Cincinnati, Boston, Buffalo and New York, have taken on the Millers Falls line of portable electric tools. This is a fortunate arrangement for the Millers Falls Company, of Millers Falls, Mass., as the Ryerson company have handled high grade electric tools for years, and their judgment and sales ability is particularly good in this field.

Manufacturers and Distributors Day at the Road Show

The attention of manufacturers and distributors is called to the importance of being in Cleveland, Jan. 12. The Road Show, which is to formally open on Monday, Jan. 14, has set aside Saturday, Jan. 12, as a day to be given over to distributors and manufacturers. This will afford an opportunity for contact between manufacturers, distributors and representatives previous to the rush occasioned by the attendance of contractors and engineers after the formal opening.

A joint meeting of distributors and manufacturers will be held late in the afternoon of Jan. 12, at which there will be a short program and matters of interest will be discussed. This day, devoted to the interests of distributors and manufacturers, is an innovation for the Road Show, and the directors of the Highway Industries Association have issued a notice urging a good attendance. The announcement further states that all exhibits should be in place by the morning of the 12th.

New Lines Wanted

Editor's Note—Distributor News receives from time to time letters from distributors wishing to be put in touch with manufacturers of certain lines of equipment which they would like to represent. Items of this kind will be published and names and addresses furnished interested persons upon request.

A man of many years' experience in the machinery business in the south would like to make a business connection for the sale of road machinery equipment.

Machinery company in the east is interested in representing established lines of road machinery, with the exception of graders.

New York company interested in representing manufacturers not already established in eastern market or considering a change in sales arrangements.

Timken Roller Bearing Co. Announces Expansion Program

In order to meet the ever-increasing demands for the products of the Timken Roller Bearing Company an immediate expansion of production facilities was called for. The program is now under way to provide equipment necessary to raise the present output of the company from 175,000 bearings to over 200,000 per day. During the current year an expenditure of about $6,000,000 was required to meet the needs, which covers additions to both steel mill and bearing factory.

Steel producing facilities now in operation have increased the capacity of the plant to 30,000 tons per month of high grade open hearth and electric alloy steels. The new facilities include the purchase of the plant and equipment of the Weldless Tube Company at Wooster, O., as well as additions to the mill at Canton.

Work is now under way on various extensions to the bearing factory for the machine equipment needed to take care of the increase in the production schedule.

Independent Pneumatic Tool Company to Enlarge Plant

The Independent Pneumatic Tool Company, 600 West Jackson Boulevard, Chicago, manufacturers of Thor pneumatic, electric and contractors tools, will build an addition to their factory located in Aurora, Illinois.

The new structure will consist of a modern, fire-proof, concrete construction building and will add 36,000 square feet to their present capacity. Plans have been drawn and approved and work will commence shortly.

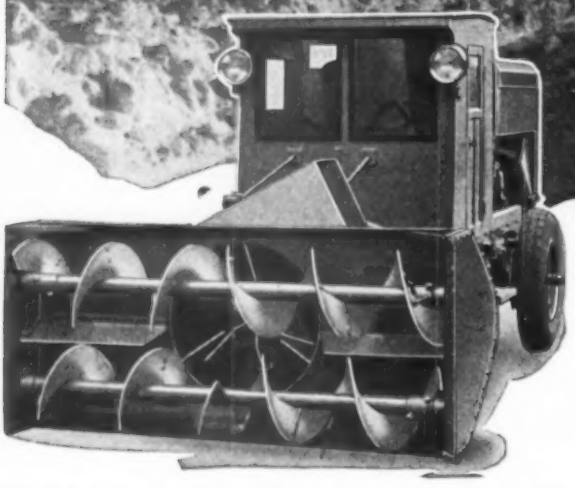
Notes on the Trade

Mr. H. A. Barker, a member of the Export Division of The Dorr Company, sailed for South America on October 13th for an eight months' visit in connection with his company's sanitary and metallurgical interests in that continent.

Mr. A. T. Hastings, who has for several years been manager of the Los Angeles office of the Dorr Company, sailed for Europe on October 20th to join the Dorr Company, Ltd., London. Mr. A. M. Kivari succeeds Mr. Hastings as manager of the Los Angeles office. The New York office of The Dorr Company, Engineers, is located at 247 Park Ave., New York City.

Mr. Harold C. Osman, secretary of the Nugent Steel Castings Company, Chicago, has been appointed Works Manager. Mr. Osman formerly was in charge of sales for that company.

Remove Those Banks!



SNOGO does a clean job—right down to the road—requires a minimum of pushing effort—Travels 25 miles per hour between drifts—Throws snow over 100 feet to either side—(direction controlled instantly from cab)—and—DOES NOT BUILD BANKS!

"Follow Your Speed Plows with SNOGO"

—and eliminate snow traps. Banks collect the snow from each succeeding storm—and make you move three times more snow than necessary.

Manufactured exclusively by **KLAUER MANUFACTURING CO., Dubuque, Iowa**

"Makers of Good Goods Since 1870"

Also Maintainers - Heavy Duty Scarifiers - Culverts - Electric Welders

SNOGO

SUCCESSFUL BEYOND COMPARISON

Yes—we would like you to mention ROADS AND STREETS.

Road Contractors Engineers
City and State Highway Officials
Valuable Information Yours for the Asking
Write Now

Catalog Service

Useful Equipment Information

Watch these trade announcements for new and improved equipment

By writing the manufacturers named and mentioning this magazine, copies of the following catalogs will be sent to you without obligation

TRADE PUBLICATIONS

Four Wheel Trailers with Under Body Hoists.—The Fruehauf Trailer Company, 10937 Harper Avenue, Detroit, Michigan, have some interesting data on the Fruehauf System of Low Cost Haulage. This engineering information, together with illustrations showing just what their products can accomplish in unloading problems, will be sent upon request. There is no obligation, simply address Mr. W. B. Chapoton at the above address, mentioning Roads and Streets.

Conveyors.—If interested in faster and cheaper handling on small jobs, write to the Barber-Greene Company, 510 West Park Avenue, Aurora, Illinois, for folder on the Barber-Green "U" conveyor. This answers the loading and handling problem of the small sand and gravel pit. This conveyor with the help of two men can do the handling work of ten or twelve. Loads trucks quickly, rapidly conveys stone, sand and gravel to screens, and cares for requirements of small crusher at minimum cost. Write to Mr. J. H. Gregory at the above address, mentioning this magazine and folder will be sent without obligation.

Paver.—Watch the announcements of Koehring Company, Milwaukee, Wisconsin, for appearance of a greater paver, which is promised soon. If interested, write to Mr. C. A. Dahlman, care of Koehring Company, Milwaukee, Wisconsin, to send you details. When writing, mention this magazine.

Explosives.—Hercules Powder Company recommend their Hercomites for lowering blasting costs. If you will write to Mr. N. S. Greensfelder, care of the Hercules Powder Company, Wilmington, Delaware, mentioning this magazine he will be pleased to send you a descriptive booklet about this product.

Blower Outfit.—The Novo Engine Company, 246 Porter Street, Lansing, Michigan, will be glad to send you without obligation detailed information concerning their new Novo Blower Outfit. This equipment is to provide a quick and inexpensive method of cleaning dirt from cracks in pavement preliminary to pouring tar. It has other uses such as blowing water from expansion joints. This is a new and interesting idea, and Mr. Clarence Bement, of the Novo Engine Company will be pleased to send you literature about it. If writing Mr. Bement, kindly mention Roads and Streets.

Cement.—Data regarding Quickard Cement, a product used for rapid construction work may be secured by writing to the manufacturers, the Ash Grove Lime & Portland Cement Co., 328 Grand Avenue Temple, Kansas City, Mo. This product meets the specifications of a true Portland cement, and pavements can be opened to traffic in 24 hours. Write to Mr. R. E. Robertson at the above address, mention Roads and Streets, for complete information concerning this product and its uses.

Road Strip.—The Kalman Steel Company are featuring a road strip intended to speed up paving operations. This product provides a smooth unbroken top edge entirely free from obstructions. A letter to this company, addressed to 410 North Michigan Avenue, mentioning this publication will bring detailed information to you. They also issue a very interesting booklet on "Driving Down Road Reinforcing Costs," to which you will be welcome if you ask for it.

Asphalt Heater.—Eight points are given by the Mohawk Asphalt Heater Company, 56 Weaver Street, Schenectady, New York, in recommending their Hotstuf Asphalt Heater. If you will write to Mr. Geo. Baker of this company he will gladly furnish you descriptive literature, prices, etc. The Chicago office of this company is at 2445 W. 21st Place, and the New York office at 49 Chambers Street. If writing for information kindly mention Roads and Streets.

Shovels, Cranes, Draglines.—The Gas plus Air equipment manufactured by the Bucyrus Erie Company, Erie, Pa., is making history for itself so rapidly that the company would like to be allowed to send you some records concerning the shovels, cranes and draglines. The Gas plus Air has direct connected, air operated engines for crowding and swinging, hence its speed without jerk or jar. Write to Bucyrus-Erie Company, mentioning this magazine for working data concerning this equipment.

Elevating Grader & Crawler.—A combination outfit, the Austin "Contractor's Special" will be described for you in detail by The Austin Western Road Machinery Company, 400 North Michigan Ave., upon request. This combination is made up of an elevating grader and crawler dump wagon, and is an aid to the contractor in handling sand in a simple and profitable way. If you will write to Mr. H. F. Barrows of the Austin-Western Company, mentioning this magazine he will be pleased to furnish you information as to how this combination cuts down costs.

Grader.—The No. 6 Motor Patrol manufactured by the Russell Grader Manufacturing Company, Minneapolis, Minn., is described in their new catalog which will be sent upon request. In addition to the new No. 6 Motor Patrol the entire line of Russell Road Machines is described: scarifiers; road drags and wheel scrapers; drag lines; conveyors; gravel screening, crushing and loading equipment. If you will write to Mr. G. E. Wennerlyn of the Russell Grader Company this catalog will be sent to you without obligation. We would appreciate it if you would mention Roads and Streets magazine when writing.

Concrete.—A new booklet giving complete details for obtaining strong concrete in 3 days with the usual materials will be sent to you upon request by the Universal Portland Cement Company. Mr. Chas. S. Rye, 208 South La Salle Street, Chicago, care of the Universal Portland Cement Company, will be pleased to send you this new booklet. Will you kindly mention this magazine when writing for information.

Winter Construction Tools.—Bulletin No. 72 issued by the Aeroil Burner Company, Inc., Park Avenue at 13th Street, West New York, N. J., will give you 16 pages of information about concrete heaters, thawing torches, mortar heaters, salamanders, water heaters, car thawing outfits, etc. The bulletin has a table of contents, and each article is fully described and illustrated and price given. If in need of tools of this type, write to Mr. E. J. Haaren, at above address, mentioning this magazine and catalog will be promptly sent to you.

Snow Removal Equipment.—"Open Roads at Low Cost" is the title on the attractive blue and white cover of a broadside just received from The Trackson Company, 500 Clinton Street, Milwaukee, Wisconsin. This folder features the Trackson McCormick-Deering crawler-tractors which can be operated at a low cost for patrol work and blizzard fighting. If you will write Mr. L. E. Dauer of the Trackson Company, mentioning this magazine he will be pleased to send you detailed information concerning this equipment.

Big jobs or Little

"Caterpillar" Tractors are made in four sizes—a size for every job of earth moving. The Sixty handles an elevating grader or a long string of self-loading scrapers, or pushes a big bulldozer blade. The 2-Ton pulls a rotary scraper, pushes a back-filler—works on the smaller tasks where nimbleness is the important thing.

Power—balanced with sure traction—these distinguish the "Caterpillar." Versatility, too, and the long life that comes from skilfully heat-treated steels.

CATERPILLAR

REG. U.S. PAT. OFF.

PRICES:

SIXTY	THIRTY	TWENTY
$4600	$2650	$2175

F.O.B. SAN LEANDRO OR PEORIA

2-TON
$1675
F.O.B. PEORIA

CATERPILLAR TRACTOR CO.

Executive Offices: San Leandro, California, U.S. A.
Sales Offices and Factories:
Peoria, Illinois San Leandro, California
Distributing Warehouse: Albany, N. Y.
New York Office: 50 Church Street
Successor to

BEST Tractor Co. — C. L. Best Manufacturing Company — HOLT

Yes—we would like you to mention ROADS AND STREETS.

Patrol Grader.—The Landreth Machinery Company of Joplin, Mo., has just issued literature concerning their new grader, the K-M Grader Patrol. The grader is adaptable for attachment to any standard tractor. It is easy to operate, simple to detach and quick to turn. Their slogan is "Saves Gas, Time and Tires." Write to Mr. John R. Key of the Landreth Machinery Co., Joplin, for full illustrated details about this equipment. If you will mention Roads and Streets when writing it will be appreciated.

Snow Removal Machinery.—Snogo, the trade name of the fast moving snow clearer is manufactured by Klauer Manufacturing Company, Dubuque, Iowa. One of the outstanding and practical features of this plow is the fact that it throws the snow a long distance to either side of the road, thus eliminating the banks. Detailed information concerning this piece of equipment will be sent upon request by addressing the company. We will appreciate it if you will mention this magazine when writing.

Snow Plow.—The Rotary Snow Plow Company of Minneapolis, Minn., manufacturers of Snow King, the rotary snow plow, will be pleased to send you complete information and prices upon request. The 1929 model of this plow is equipped with chutes for throwing the snow in any direction desired. If writing to Mr. George Niess of the Rotary Snow Plow Company for literature concerning this equipment, kindly mention this magazine.

Metalvane Snow Control.—A practical, portable emergency snow barrier manufactured by the Metalvane Snow Control Corporation, of Sioux Falls, South Dakota, is fully described in the bulletin "Economical Snow Control." The three outstanding features of this method of snow control is, first, that it can be placed wherever drifts may be expected, second, that it is portable and can be used without injury to property, third, that it is lasting and can be used year after year. If writing for a copy of "Economical Snow Control" kindly mention the name of our magazine.

Governors for Automatic Speed Control.—Complete information of the Pierce Governors and what they can do is to be found in Booklet No. 14 issued by the Pierce Governor Company, Anderson, Indiana.

Concrete Pipe.—The Portland Cement Association, 33 West Grand Avenue, Chicago, issue a booklet on "Concrete Pipe Sewers" giving full details and illustrations on the requirements of concrete needed to meet both the normal and abnormal conditions which must be considered by the engineers in designing sewer construction. If you will write to Mr. C. R. Ege, of the Portland Cement Association, mentioning this magazine he will be pleased to send you a copy of this booklet.

Shovel-Crane.—The American Hoist & Derrick Company, of St. Paul, Minn., will be pleased to send you a copy of their catalog giving details and illustrations of their "American Gopher" Shovel-Crane adaptable for shovel, dragline, clamshell or crane work. Write to Mr. E. P. Brown, c/o American Hoist & Derrick Co., of St. Paul, for a copy of this new catalog. We will appreciate it if you will mention our magazine, if writing.

Steam and Electric Shovels.—Several attractive new bulletins, No. 334, No. 335, No. 336 and No. 337, have just been received from the Marion Steam Shovel Company of Marion, Ohio. These are all descriptive of the new Type 480, 2-yd. revolving shovels, operated under different methods of control. No. 334, with a cover of apple green, to distinguish it from its mates, concerns the electric rheostat control. Type 480 has been built to supercede Type 37. The new machine has all the inherent qualities of its precedessor, but is heavier, more powerful, better balanced and better appearing. It is the result of nearly half a century of experience. It is a three motored direct current shovel, with rheostatic control. Ask for Bulletin No. 334 describing this type shovel. This Ward Leonard type control of three motored direct current machine has several operating conveniences which account for its higher first cost. The advantages of this type are the ability to approach closely the steam shovel characteristics and the removal of heavy currents from the controllers. This booklet has a distinguishing cover of deep red. It is No. 335. The gas-electric type of control, which dates back about 20 years, is described in Bulletin No. 337, a dark green front cover characterizes this booklet. It has the "flexibility of steam with the convenience of gas." The gas-electric idea is peculiarly applicable wherever heavy pull at low speed and high speed at light load are needed. The fourth bulletin of the series is No. 336. This describes the steam type machine. This bulletin is clothed in a purple cover. The entire series are handsomely illustrated and printed on heavy enamel paper. Write to Mr. C. H. Gibbons, Marion Steam Shovel Company, Marion, Ohio, for this satisfying group of booklets. We would appreciate it if you would mention the name of this magazine when writing.

Rock Crushers.—The New Holland Machine Company of New Holland, Pa., has just issued Bulletin No. 100, presenting type K of the New Holland Rock Crushers. This bulletin contains the purposes of these crushers, testimonials of users of them, and general specifications with cross sectional drawings. This company manufacture a long list of equipment, including besides the crushers, bucket elevators, pulverizers, gas engines, hammer crushers, roller crushers, conveyors of all types, sand washers, portable loaders, revolving screens, vibrating screens, automatic feeders, bin gates and chutes, chain, sprockets, gears, belting, castings, power transmission equipment, etc. If you will write to Mr. J. R. Eshelman, of the New Holland Machine Company he will gladly send you a copy of this bulletin. If asking for information, kindly mention Roads and Streets magazine.

Oil Burning Heater.—Connery & Company, Inc., 3900 N. Second Street, Philadelphia, Pa., issue a "Blue Book" describing their complete line of equipment for road contractors and municipalities requiring hot tar and asphalt in a hurry. Pouring pots, hand spraying attachments, torches, tar and asphalt kettles, etc., are included in the equipment manufactured by this company. If requesting copy of "Blue Book" we would appreciate it if you would mention our publication.

Snow Plows.—Twenty models, including "V" and blade types for trucks and tractors and two models of truck speed plows are described in the Snow Plow Literature of The Baker Manufacturing Co., 506 Stanford Avenue, Springfield, Illinois. In writing for this literature give the name and model of truck or tractor in use, and we would like to have you mention the name of this magazine.

Tractors.—The Bates Manufacturing Company of Joliet, Illinois, have issued a new catalog illustrating and describing models Bates 28, Bates 40 and Bates 70 tractors. Write for your catalog, giving the name of this magazine.

Drainage Systems.—A booklet containing valuable information for engineer and contractor is issued free upon request by the Domestic Engine & Pump Company, N. Queen St. and P. R. R., Shippensburg, Pa. Ask for "Excavating in Pre-Drained Wet Soils." This is a copyrighted piece of literature and the edition is limited. If writing for your copy, will you kindly mention our magazine?

Rotary Fresno.—The Western Rotary Fresno hauls up to 200 yards and is to be used with small, fast tractor, both operated by one man. It is a model of efficiency in earth moving. For particulars concerning this equipment write for Bulletin 28BRS, Western Wheeled Scraper Company, Aurora, Illinois.

Graders.—The Galion Iron Works & Mfg. Co., of Galion, Ohio, issue fully illustrated literature describing the Galion E-Z Adjustable Leaning Wheel Graders. The latest patent covered improvement on this piece of equipment is the Automatic Pivotal Rear Axle. This company will be pleased to send you information concerning this machinery. If writing kindly mention our magazine.

Concrete Roller.—The Macon Concrete Roller Company of Macon, Georgia, will be pleased to furnish you with particulars concerning their Macon Concrete Roller, a simple road finisher

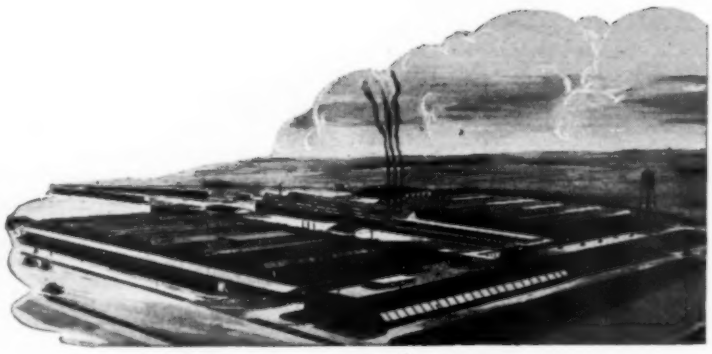
Again Cleveland Welcomes You —

Public Hall — Place of the Convention and Road Show
January 14th to 18th, Cleveland, Ohio

AGAIN this year the city of Cleveland will be the gathering-ground for the great road-building fraternity at its TWENTY-SIXTH ANNUAL CONVENTION and GOOD ROADS SHOW! For five big days it will be the mecca of the highway industry. For five big days it will deal out pleasure and profit to all who come.

Everything is in readiness — for a successful convention, a great exhibition and a whale of a good time. Plan to be there — January 14th to 18th — and see the greatest array of road-building, maintenance and contractor's equipment ever assembled at one point

Again Cletrac Invites You!



The Cletrac Factories and Office
19300 Euclid Ave., Cleveland, Ohio

CLEVELAND is the *home* of CLETRAC CRAWLER TRACTORS and again this year the Cletrac factory extends you a special invitation to visit its large plant while at the convention. Special entertainment is on the program and special demonstrations of Cletracs with various types of equipment will be held. Our factory exhibit is one in which many other manufacturers of contractor and road building machinery are taking part.

See the big show and the Cletrac exhibit at the Public Auditorium by all means — but don't fail to visit the Cletrac Factory, where big preparations have been made for your visit.

The Cleveland Tractor Co.
Cleveland, Ohio

Do you mention ROADS AND STREETS when writing? Please do.

for operation by unskilled labor. The low price is an attractive feature of this concrete roller. If interested write to the manufacturer, giving the name of our publication.

Truck Turntable.—A truck turntable built in three sizes to handle one, two and a half and three ton trucks is manufactured by the Western Structural Company, Moline, Illinois. They will be pleased to send you a circular giving full particulars about this time saving piece of equipment. We would appreciate it if you would mention this magazine when writing for information.

Rotary Screen.—The catalog issued by the F. S. Converse Co., Inc., of Corliss Avenue, Johnson City, New York, gives details and illustrations of their Converse Rotary Screen for sand, gravel and crushed stone for highway work. Separation of the various sizes requires but one operation. Write for this catalog, mentioning this magazine.

Power Plow Scrapers.—The Engineering Department of the Garst Manufacturing Company, Chicago, Illinois, have prepared literature on the reasons why their Power Plow Scrapers cut handling costs. These plow scrapers dig as they convey and are good for all kinds of soils. They can be operated efficiently by one man or two men. They have an operating radius of 400 feet, and not only convey to a central delivery point but are widely used for storing material. Much interesting information about these plows will be furnished by this company upon request. Will you kindly mention this magazine when writing.

Drill Sharpener Catalog 6072.—Issued by the Sullivan Machinery Company, 76 East Adams Street, Chicago, describes in detail the new Sullivan Portable Drill Sharpener. This piece of equipment is an aid in increasing profits and speeding up drilling. The steel is worked entirely by hammering and made exactly to gauge. If requesting this catalog, kindly mention our magazine.

Concrete Reinforcements.—If interested in a report on the results of the use of welded steel fabric in road work, write to the National Steel Fabric Company, 1811 Union Trust Building, Pittsburgh, Pennsylvania, asking for a copy of their book on Application of Results from Road Surveys. If you will mention Roads and Streets magazine this book will be sent to you without obligation. National Reinforcing product is adaptable to every kind of reinforcing concrete work.

Culverts.—The Armco Culvert Manufacturers Association of Middletown, Ohio, would like to furnish you with information regarding the lasting qualities of culverts built from Armco Ingot Iron. If writing for this information, kindly use the name of Roads and Streets magazine.

Cranes.—For specifications, operation and maintenance of the Utility Buckeye, manufactured by the Buckeye Traction Ditcher Company, Findlay, Ohio, write to Mr. D. C. Royce and ask him to send you their Crane Bulletin. When making this request give the name of our magazine. This utility crane may be used as backfiller, clamshell, crane, ditcher, dragline and truck-crane.

Gas Shavel.—The Ohio Power Shovel Company, Lima, Ohio, will send upon request descriptive literature about the Lima "101" gas-shovel with capacities of 1 yd. and 1¼ yd. Kindly mention Roads and Streets magazine if writing to Mr. Grant Davis, at Lima for this information.

Road Guards.—The engineering department of the American Wire Fence Company, 7 So. Dearborn Street, Chicago, Illinois, offer their services in your highway safety work. A letter addressed to Mr. J. T. Hanley, care of this company will bring you information concerning this modern system of road protection. As a courtesy will you mention the name of Roads and Streets when writing.

Engines.—A series of bulletins, telling the story of the Stearns "extra reserve" four cylinders 55 hp., 70 hp., 80 hp.; and 120 hp. six cylinder engines are yours for the asking. Each of these bulletins gives in four pages full engineering data. This information will be found of great service to users of gasoline or kerosene engines. There is no obligation attached to this service, simply write to Mr. C. A. Robertson, Stearns Motor Mfg. Company, Ludington, Michigan, mentioning Roads and Streets magazine and ask for the Engineering Bulletins.

Crushers.—The Iowa Manufacturing Company of Cedar Rapids, Iowa, issue a complete catalog treating of crushers and crushing equipment for handling rock, sand and gravel. Their one piece outfit in one operation crushes, screens and loads. Write to Mr. John H. Jay, Iowa Manufacturing Company at Cedar Rapids for a copy of this catalog if interested in this type of equipment. If you will mention Roads and Streets when writing, we shall appreciate it.

Road Guards.—The Cyclone Fence Company offer to any one interested specifications and details for working out safety campaigns. This information is based on programs now being carried out by leading highway commissions. If desiring this information, write to Mr. G. H. Kinney, Cyclone Fence Company, at Waukegan, Illinois, using the name of our magazine.

Crushers.—Write for Catalog No. 153, concerning Telsmith Primary Breaker, and 2F3 on the Telsmith Reduction Crusher, issued by the Smith Engineering Works, 82 Capitol Drive, Milwaukee, Wis. The great crushing capacity of this equipment is accounted for by its great feed area. These bulletins are free, and will be sent without obligation if you will kindly mention Roads and Streets.

Rock Drills.—On request the Chicago Pneumatic Tool Company will send you a copy of their Rock Drill Bulletin. This Bulletin shows the CP drills with air supplied from the CP Portable Air Compressor producing capacity results. Write to Mr. H. H. Sherman of the Chicago Pneumatic Tool Company, 6 East 44th Street, New York City, for this catalog on Rock Drills. We will appreciate your mention of Roads and Streets when writing.

Twin Disc Clutches.—These clutches made in sizes and style to meet practically all demands of heavy duty industrial machinery are manufactured by the Twin Disc Clutch Company, Racine, Wis. They would like to send you literature about them. Write for information and prices. When writing kindly give the name of our magazine.

Tractors.—For specifications and descriptive literature concerning Cletrac Crawler Tractors, write to Mr. H. E. Orr, The Cleveland Tractor Company, Cleveland, Ohio. These tractors are built in sizes ranging from 20 to 100 horse power, and are equipped with the "one-shot" instant oiling system, an exclusive Cletrac feature. If writing for information on this tractor kindly mention Roads and Streets.

Trucks and Tractors.—The International Harvester Company would like to send you detailed information about their highway construction equipment. Or call at their nearest branch office and ask where their trucks and tractors can be seen at work. This company has 169 branches where particulars will be gladly furnished regarding this machinery. If seeking information kindly mention the name of this magazine.

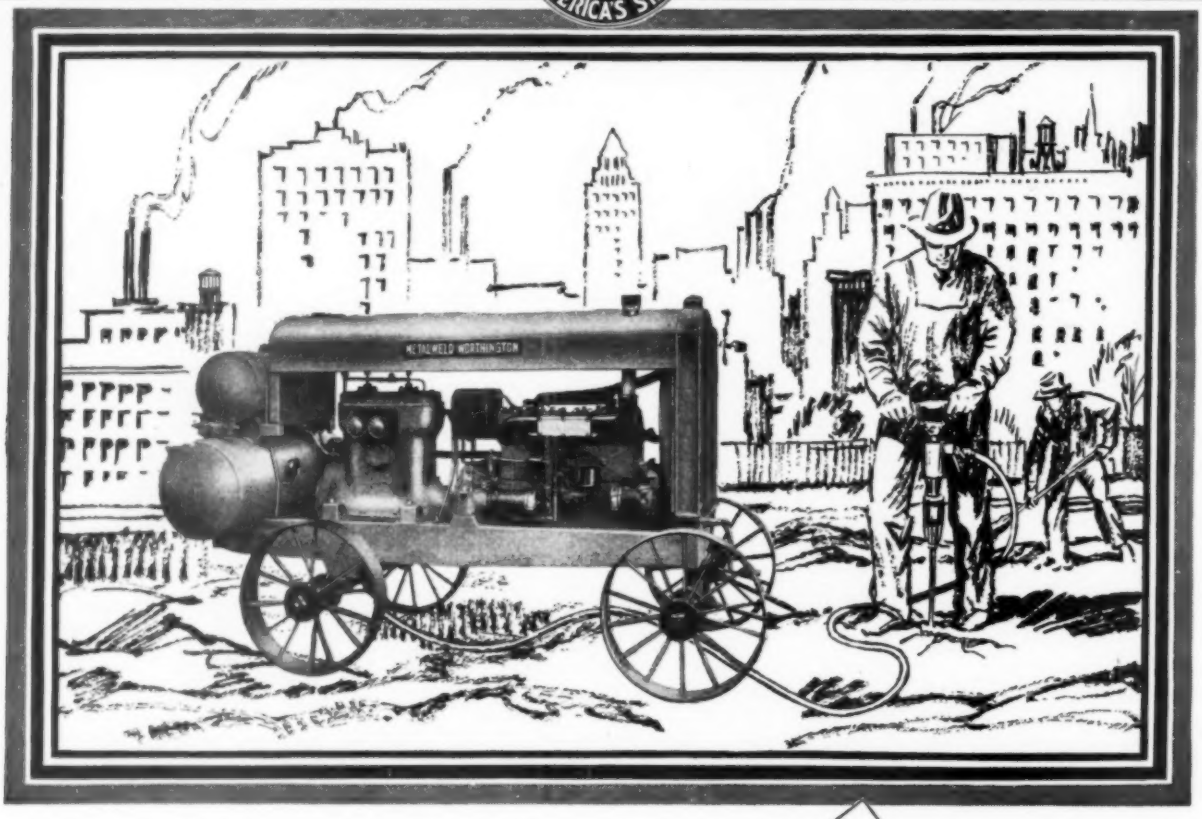
Shovels, Cranes, Draglines and Trailers.—These products of the Speeder Machinery Corporation, 1211 South Sixth Street, West, Cedar Rapids, Iowa, are described in their catalog which will be sent upon request. All Speeder equipment is now furnished with electric lights and starter. The Pioneer ½ yard full revolving, fully convertible gas shovel is one of the features described in this catalog. Send for your copy and when doing so, mention this magazine.

Diesel Engine.—For convincing information on the speed and pulling power of the Buda M. A. N. Diesel, write to the Buda Company, Harvey, Illinois, for Bulletin 654 M. Low cost of operation and high tonnage records are outstanding features of this engine, in addition to the ease of operation. If writing for this bulletin, kindly mention Roads and Streets magazine.

Truck Crane.—Bulletin 639X issued by the Harnischfeger Corporation describes in detail the P & H equipment. The interchangeable features make readily attainable clamshell, dragline, crane, magnet crane or pile driver. The P & H Truck Crane will unload coal, sand, stone, pipe, tile, etc., erect

Dependable Power for Every Purpose

CONTINENTAL MOTORS · Power of the Nation · AMERICA'S STANDARD

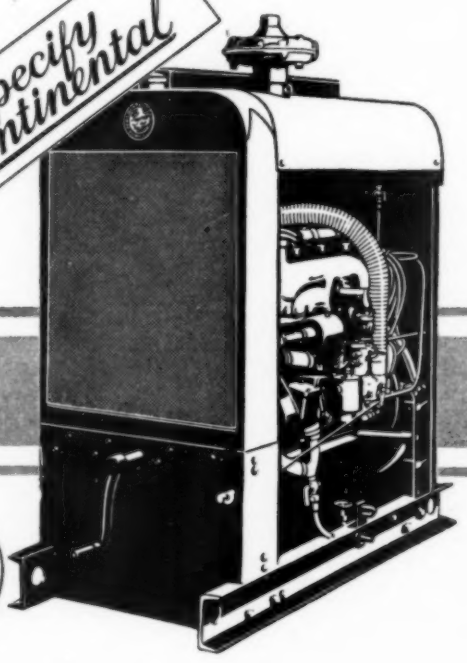


—With Portable Compressors

That Metalweld-Worthington Air Compressors stand up under terrific strains accounts in part for their wide popularity.

Above is shown a 210 cu. ft. Metalweld-Worthington Compressor in action powered with a Continental B7 engine and equipped with electric starter.

Specify Continental



FOR SUCCESSFUL PERFORMANCE · A.G.C. · A.

Red Seal Continental Industrial Products will be on exhibit at the Cleveland Road Show.

CONTINENTAL MOTORS CORPORATION
INDUSTRIAL EQUIPMENT DIVISION
Office and Factory: Muskegon, Michigan
The Largest Exclusive Motor Manufacturer in the World

Continental Motors

When writing to advertisers please mention ROADS AND STREETS—Thank you.

transformers, machinery and structural steel, build retaining walls, etc., and moves from job to job at truck rate of speed. Mr. H. S. Strouse of the Harnischfeger Corporation, 3896 National Avenue, Milwaukee, Wisconsin, will be pleased to comply with your request for a copy of Bulletin 639X. Will you mention our magazine if writing?

Snow Plows.—The Gettelman Hi-Speed Snow Plow will operate in dry snow at a speed up to 35 miles per hour. Write to Mr. H. F. Pugh, The Heil Company, 1138-1150 Montana Avenue, Milwaukee, Wisconsin, for Bulletin No. 183 giving complete information and illustrations for this light, fast, strong plow.

Steel Wheels.—For use on graders, maintainers, tractors, trucks, trailers, scrapers, wheel barrow, carts, etc. French & Hecht, Inc., wheel builders, of Davenport, Iowa, and Springfield, Ohio, will gladly furnish information concerning wheels to meet any requirements or design. For this detailed information write to this company at either of their plants, mentioning the name of this magazine.

Trailers.—The Rogers Brothers Corporation, 116 Orchard Street, Albion, Pa., have just issued a new catalog describing the practical features of the Rogers Goose Neck Heavy Duty Trailers. It is made in capacities from 5 to 100 tons and built to carry loads in excess of ratings. For economically moving steam shovels, cranes, ditchers or other heavy machinery this heavy duty trailer is built to serve. When writing for the new catalog, we would appreciate your mentioning this magazine.

Compressors. — The new 1928-29 catalog of Schramm, Inc., of West Chester, Pa., is now ready, write for yours, which will be sent without obligation. Schramm, Inc., are manufacturers of compressors for every type of job and mounting requirement, in sizes 15 up to 360 cu. ft. gas, electric or belt drive. The catalog fully describes and illustrates this equipment.

For Snow Removal. — The Good Roads Champion Snow Plows, designed for attaching to motor truck equipment of all kinds, are fully described in catalog K. S. P. issued by the Good Roads Machinery Company, Inc., Kennett Square, Pa. The Model 21-B Good Roads Champion High Speed Plow, equipped with two-speed lifting device, has a minimum plowing width of 11 ft. and maximum of 16 ft. Clearance at front end when lifted is 36 in. It is designed for use with 3½-ton trucks and heavier. There are fourteen different models to choose from in order to best meet your requirements. Full information concerning the Good Roads-Westinghouse Pneumatic Lifting Devices will be furnished upon request. This company has offices in all the principal cities. If writing for information kindly mention this magazine.

Snow Removal Equipment.—The Monarch Tractors Division of the Allis-Chalmers Manufacturing Company has just issued a very attractive little booklet on Monarch Tractors for the removal of snow. The story of how to free the roads of snow in a quick and economical way is presented in this booklet. Specifications are given of Tractors "50" and "75." The Monarch Tractors Corporation of Springfield, Ill., is a subsidiary of Allis-Chalmers Manufacturing Company which is located at Milwaukee.

Caterpillar Tractors.—Issue No. 32 of The Caterpillar Magazine presents concrete stories and illustrations of the almost endless uses to which the Caterpillar can be put. Particular attention is called to the service of this piece of equipment for airport building, and the fact that "every dropping off" place may soon become a "dropping down place" necessitating the building and maintaining of airports. Write to Mr. W. H. Gardner, San Leandro, Calif., for further information and a copy of the magazine, mentioning our publication.

Dual Control Trencher.—Bulletin 20-X gives detailed information regarding the P. & H. Trencher manufactured by the Harnischfeger Corporation, 3902 National Ave., Milwaukee, Wis. One of the important features of this equipment is the fact that the operator can work from either side. This company has branches in all the principal cities. Write to Mr. H. S. Strouse for copy of this bulletin, mentioning this publication.

Snow Removal Machinery.—A very attractive red, white and blue broadside has just been received from the Cleveland Tractor Company, Cleveland, O., making the problems of heavy snows seem simple when met with this snow removal machinery. Two Cletrac 40's are part of the equipment chosen for the Byrd South Pole Expedition. Mr. H. E. Orr is advertising manager of this company.

Industrial Cars and Equipment.—Catalog No. 100, issued by the Koppel Industrial Car & Equipment Co., Koppel, Pa., is a reference book and guide for use in the construction of good roads, treating of modern and efficient hauling systems. This catalog is published for the use of highway engineers, state, county and township authorities and road contractors. The booklet contains much helpful data, cross sectional drawings, and specifications and illustrations of equipment. There is a glossary of road terms, published at the recommendation of the Society of Civil Engineers. The catalog contains 50 pages, printed on heavy enamel paper and is firmly bound. A convenient and useful book. In addition to the larger catalog, bulletins No. 43 and No. 51 have been issued by the same company, featuring batch boxes, portable track, koppel cars and other equipment.

Automatic Air Lift.—The Sullivan Machinery Company, 130 North Michigan Ave., Chicago, Ill., has a handbook on their automatic air lift, and special automatic control information of particular interest to water works superintendents. A letter to the Sullivan Machinery Company, attention of Mr. S. B. King, will bring you this information. In writing mention Municipal News and Water Works.

Tractors.—The Allis-Chalmers Company of Milwaukee, Wisconsin, has just issued a multi-colored broadside giving specifications and detailed descriptions of Allis-Chalmers 20-35 tractors. Mr. H. G. Hoffman will be pleased to send full information for this company upon request. Will you kindly mention Roads and Streets, if writing.

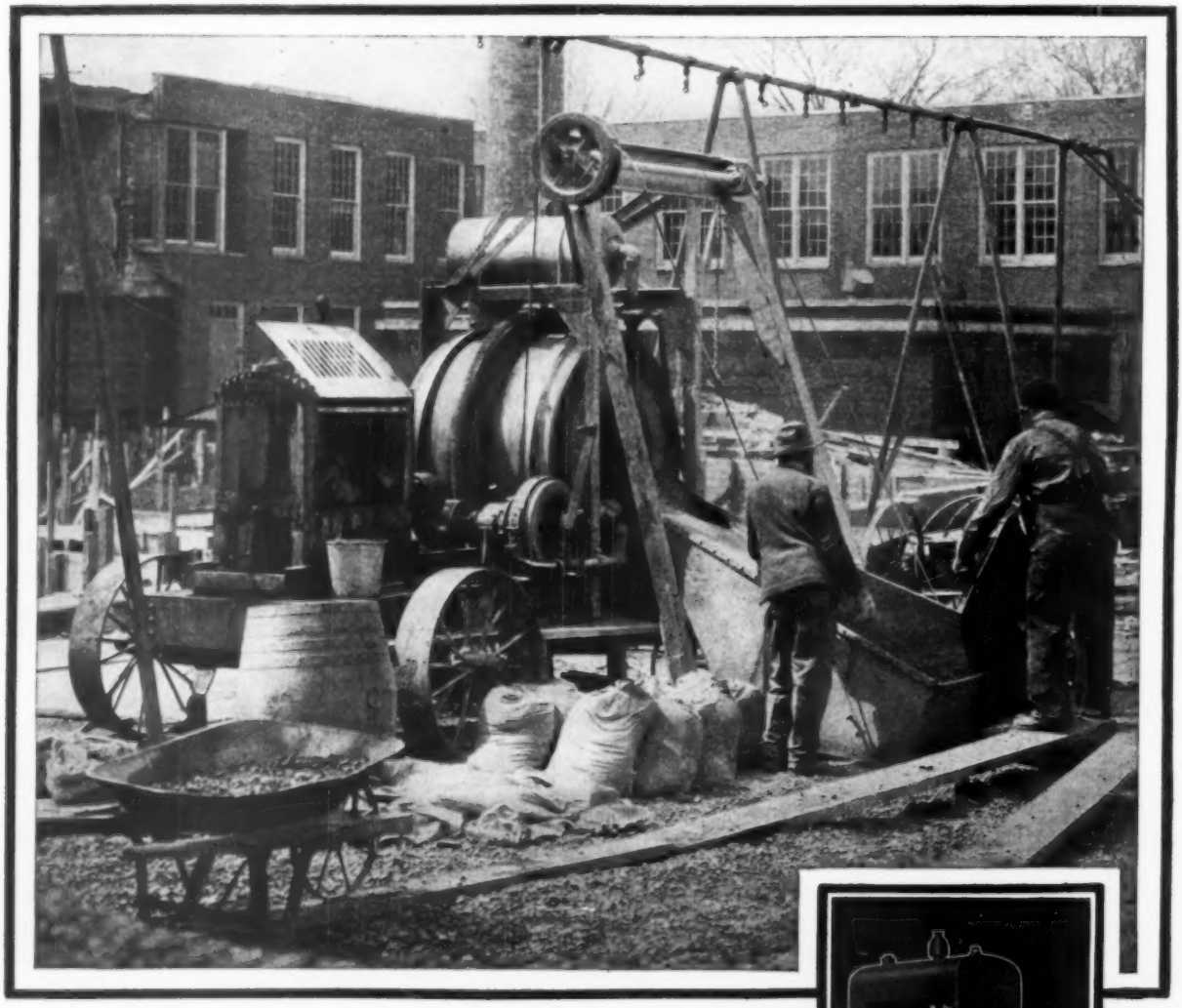
Dragline.—Write to Koehring Company at Milwaukee, Wis., or to any of their branches in the principal cities, for Dragline Bulletin DL9. The ease of control and speed in functioning are important features of this heavy duty Koehring equipment. Mr. O. C. Dahlman will furnish bulletin or other information on request. When writing please mention this magazine.

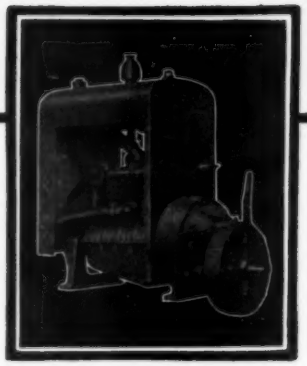
Engineers' Instruments.—A very complete catalog containing 134 pages is available concerning instruments, equipment and supplies for engineers, draftsmen and architects. It is issued by the A. S. Aloe Company of 1819 Olive St., St. Louis, Mo. Every item is illustrated and price given. The catalog is well indexed and should be very helpful to the engineering profession in renewing or completing their equipment.

Centrifugal Pumps.—In order to be of assistance to users in choosing the right pump for their needs, Bulletin 1632-I has been issued by Allis-Chalmers, Milwaukee, Wis. Types for steam turbine drive, motor drive or gasoline engine drive are described to best fit the purposes of installation. Write to Mr. H. G. Hoffman for copy of this bulletin, mentioning Municipal News and Water Works.

Chemicals.—This is the title of a very handsome catalog issued by the Kalbfleisch Corporation, 200 5th Ave., New York. Printed on heavy enamel paper, buff bordered, with display type in blue, and heavy blue cover, its eighty-four pages make a strong appeal for the reader's interest. This corporation has a background covering a period of a century of identification with the chemical industry of the United States. The first part of the booklet is devoted to the sources, manufacture and uses of chemicals, and a long list of chemicals manufactured by this company; industrial chemicals—chemicals for paper industry and miscellaneous chemicals. The tables at the back of the book give atomic weights, corrections for temperature, and many other tables to serve the chemical user.

TEN YEARS OF *faultless operation*





EARLY in 1918—the O. F. Miller Co. of Kalamazoo, Mich., played a "hunch". They wanted a 4 cylinder gasoline engine to use on a mixer. They scanned the field of engines and *gambled on a Le Roi.*

Now,—in 1928—Mr. Miller says: "And at this time after 10 years of wonderful service, the Le Roi Engine functions as faultlessly as the first day it was used". That's typical of Le Roi Engines, long lived and dependable—and more—lowest operating and maintenance costs per day and per year. *Know the Le Roi by what it does.*

LE ROI COMPANY, *Milwaukee*

1929 ROAD SHOW
Cleveland
Jan. 14

LE ROI ENGINES

3 *to* 160 HORSE POWER

Please mention ROADS AND STREETS—it helps.

Marion Announces New Group of Shovels

The Marion Steam Shovel Company announces the introduction to the trade of a new group of 2 cu. yd. shovels—the type 480. These machines are of the same general construction and capacity. They have uniform underframe and crawler construction, uniform boom, handle and dipper dimensions. Their crane, clamshell and dragline equipments are uniform. They are, however, built with three types of primary power supply. The one following the longest line of historic precedent is the steam powered 480. Another is the electric 480. The last, and latest—the carefully engineered and fully tested diesel-electric 480.

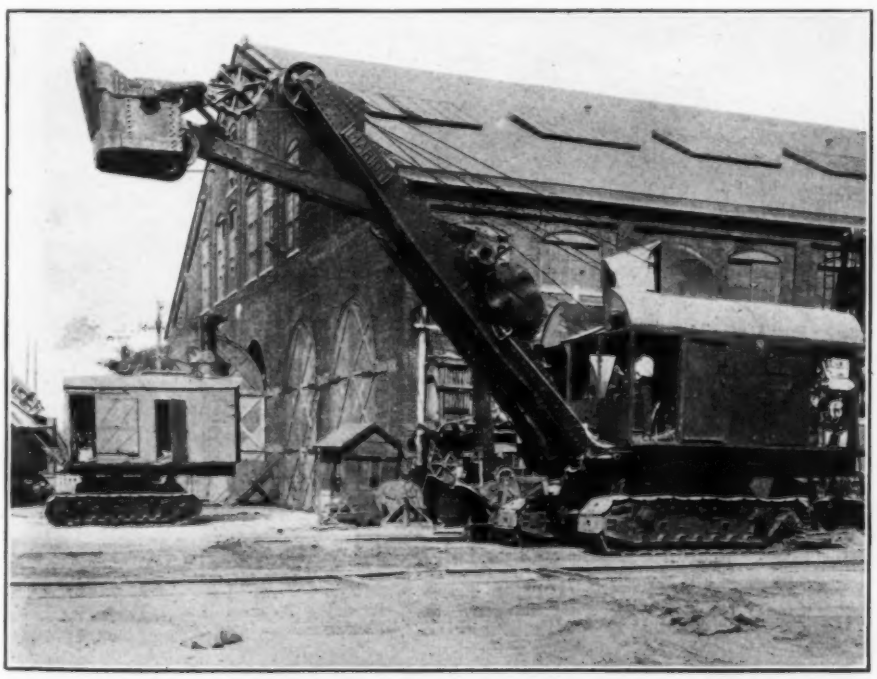
With 25-ft. railroad shovel type boom—combination wood and steel; with 17-ft., inside dipper handle—also wood and steel and 2 cu. yd. dippers they follow closely the designs of the Marion Type 37. The new 480, however, is heavier, more rugged, more powerful, with better balance and having better appearance. Bearings are bronze bushed throughout. Propelling is through spur gearing at all points of heavy tooth load. A patented handle spacer prevents "bowed" dipper sticks. Sheaves and drums are exceptionally large, slide plate and yoke block is of steel and one piece—all are the results of experience extending over nearly half a century.

On the electrics great improvement has been made in the electrical equipment. Not only has advantage been taken of the latest product of the equipment manufacturers but also of certain features of control perfected and patented by Marion engineers. These have brought the electrics so closely to steam characteristics that in flexibility and convenience of operation they are a revelation to the owner as well as to the operator. In fact throughout a portion of the duty cycle, it is claimed, they are superior to the steam and through another portion the equal.

The diesel-electric is a new development. A Winton diesel engine direct connected to a direct current "drooping voltage" generator supplies the power for the electric motors which are geared individually to hoist, swing and crowd. From generator to dipper the diesel-electric is a duplicate of the electric and incorporated therein are all the advantage giving features noted in connection with the electric. The diesel engine horsepower is 150 at 750 r.p.m. The generator is 50 kw. and the hoist motor is 90 horsepower, 60 min. rating, while swing and crowd motors are 30 horsepower. For short periods and in typical shovel service the generator and motors will deliver several times their ratings.

The diesel is a 6 cylinder 7 in. x 8½ in., 4-cycle airless injection engine. Crank shaft has seven bearings, 4¼ in. diam., and is of chrome nickel steel with ground journals. Starter is Winton Standard, operates at 400 lb. air pressure and is efficient and thoroughly reliable. An auxiliary gasoline engine driven air compressor is also provided as are necessary fuel oil tanks, air tanks, pumps, etc.

Further information about this new line of power shovels may be obtained from Mr. C. H. Gibbons, The Marion Steam Shovel Company, Marion, Ohio.



Marion Diesel-Electric Shovel—Type 480

Allis-Chalmers-Monarch Announce Models for Winter Work

The Allis-Chalmers-Monarch "50" and "75" tractors have been equipped for winter work, with fully enclosed weatherproof cabs, constructed to keep the operator warm in the most inclement weather conditions. Full vision glass panes offer maximum visibility. Cabs on both models are roomy, providing comfort for the operator. Special easy detachable and self-cleaning ice and snow grousers, it is claimed, assure positive traction for snow removal and winter logging work. Tracks with grousers cast integral can also be furnished.

Allis-Chalmers-Monarch Equipped for Winter Work

These models having great reserve power are especially adapted to snow removal work. Various makes of heavy "V" type and rotary plows are easily attached. This is a desirable combination in removing the snow blockade quickly and surely.

Snow blockades cost the United States and Canada hundreds of millions of dollars annually. They tie up commerce, increase manufacturing and transportation costs, damage road and highway surfaces, increase fire hazards, delay mail service, and cause endless inconveniences. Every year the terrific toll exacted by snow blockades is felt by hundreds of thousands of people in every walk of life, by every city, large and small. Everywhere, taxpayers and public officials are awakening to the realization that their roads must be kept clear—that their concrete highways which cost them approximately $30,000 per mile of their own money must receive the best winter protection that can be procured. Protection against the wastes of snow blockade means only one thing—efficient, dependable snow removal.

Complete details of the above models can be obtained by writing for the booklet, "The Removal of Snow," to Monarch Tractors Corporation, Springfield, Ill.

Sweeping The Industrial Field *now Lakewood* *Swings* To Novo Rollr Power

See Novo at the Road Show
Booth WW-4

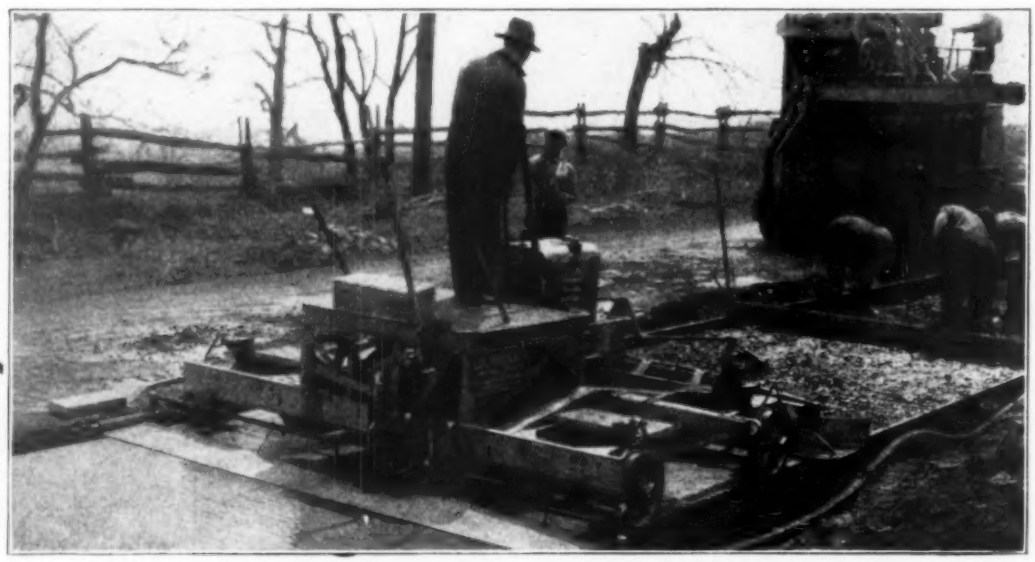
On and on, like a great tital wave, Novo power is sweeping the industrial field. For manufacturers are finding in Novo 1, 2 and 4 cyl. engines a *new type of performance*—that means smoother operation—longer life—and lower maintenance costs for both the engine and the equipment it powers.

And now the Lakewood Type F Screed runs smoothly and surely on Novo Rollr power.

For the Lakewood Mfg. Company found that the *vibrationless* operation of the Novo 2 Cyl. Rollr Engine enabled their Type F Screed to turn out much smoother pavement than had been possible before.

And, as so many industrial users have learned, Novo Rollr Engines do much more than eliminate vibration — tests show ½ the gas consumption — several per cent more horse power — quarter turn cranking — unusual durability and other important advantages that mean satisfied users.

Write for complete information and a copy of the special Novo Rollr Engine catalog today.



A smoother concrete road for Novo 2 cylinder Rollr Engines now used on the Lakewood Type F Screed lick vibration as it has never been licked before.

NOVO ENGINE COMPANY, 246 Porter St., Lansing, Mich.
CLARENCE E. BEMENT, Vice-Pres. and Gen. Mgr.

NOVO

PUMPS — ENGINES — HOISTS

Service, parts and sales in 65 cities

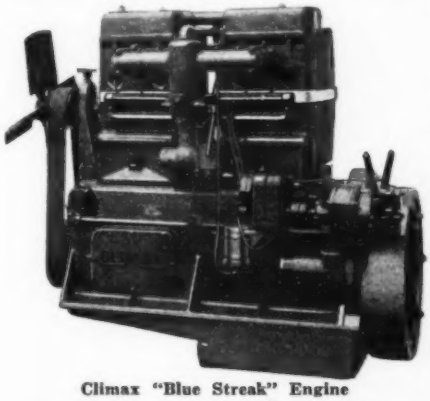
Please mention ROADS AND STREETS—it helps.

Climax Announces "Blue Streak" Engine

The industrial manufacturers of powered equipment are being offered a new 4-cylinder valve-in-head engine built by the Climax Engineering Company of Clinton, Iowa. This new engine, called the "Blue Streak," is only a 6 x 7, but it developed better than 110 hp. at 1,200 r.p.m. on block tests. The wide range of power developed by the "Blue Streak" is shown in the following table:

R.P.M.	H.P.	Pounds of Fuel per H.P. Hour
500	50	.62
600	62	.61
700	73	.60
800	83	.58
900	92	.57
1,000	100	.57
1,100	106	.575
1,200	110	.59

The new design and construction of this engine also offer new economies in fuel consumption. It delivered from 10 per cent to 12 per cent more power than the ordinary 4-cylinder 6 x 7 internal



Climax "Blue Streak" Engine

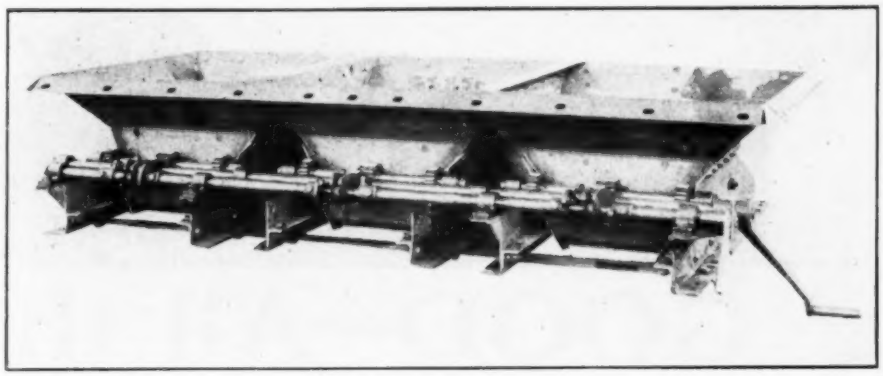
combustion engine using about 10 per cent less fuel per horsepower hour under full load running at 1,000 r.p.m.

In addition, the new Climax "Blue Streak" is said to be built on new service-winning standards. It has simple cylinder barrels; large water jackets to prevent the distortion of cylinders; valves have large cooling areas to prevent the warping of valve seats; hold down bolts are so located that gasket troubles are virtually eliminated; a vacuum spark control that works automatically; and many other features that eliminate in-the-field difficulties and costly delays.

For further information about this engine write Mr. Henry Greenbaum, The Buchen Co., 28 E. Jackson Blvd., Chicago, or Sales Manager, Climax Engineering Co., Clinton, Iowa.

Triple Gate for 3-Compartment Bins

The use of two sizes of coarse aggregate in the making of concrete is rapidly becoming popular in a number of localities, and this presents the problem of conveniently and accurately controlling the flow of three materials into one weighing hopper.



Blaw-Knox Triple Gate for Bins

The Blaw-Knox Company have solved this problem by the development of a triple gate, all three openings being controlled from one point. This arrangement allows the operator to control the charging and discharging of the weighing batcher from a position directly in front of the reading beam of the scale, upon which the batcher is suspended.

The device consists of an arrangement of three standard trough shaped no-jam gates parallel to each other, operated by means of rack and pinion. An arrangement of sliding gears, actuated by turning an auxiliary shaft, engages each gate pinion separately with the operating crank.

The operator by simply turning the shifter shaft, which is equipped with an indicator may select any one of the three gates at will without a moment's loss of time.

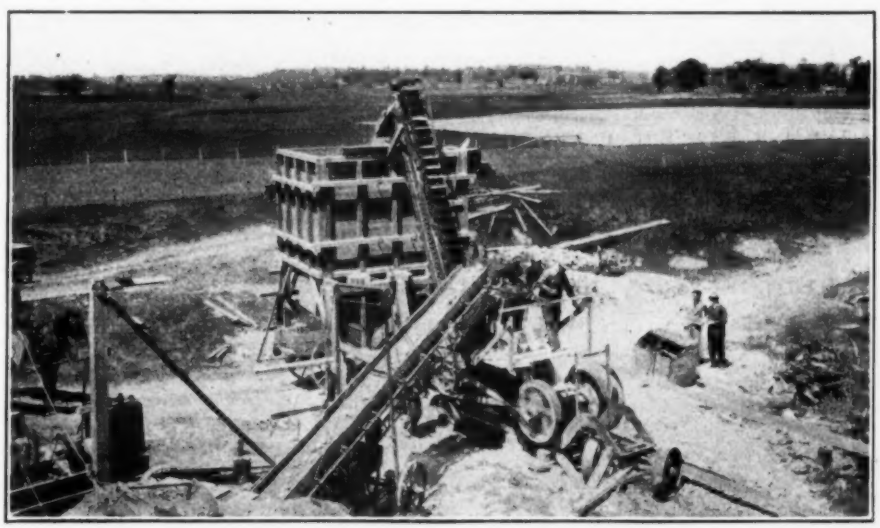
Write Mr. A. E. Holman, Blaw-Knox Co., Pittsburgh, Pa., for further information.

Bakstad Announces Portable Crushing Plant

The Bakstad Crusher and Equipment Corporation of Chicago have announced a 3-jaw type of crusher mounted on a 4-wheel truck for use in portable crushing plants. They manufacture the plant complete. It is equipped with a by-pass grizzly screen above the receiving mouth of the crusher and a continuous bucket elevator of the folding type. The unit may be driven by auxiliary power from a farm tractor or otherwise. To accompany the crushing unit they have designed an inexpensive timber bin. The bin which is erected on the job, consists of a number of support bents of duplicate construction. On this is placed the four side walls of the bin. They are built in panel construction and tied together with corner bolts and tie-rods. The flooring is laid loose inside.

One of these outfits was recently built for Holland Township, Cedar Grove, Wisconsin. They are using a Sauerman ½ cu. yd. power scraper with double drum hoist for excavating the gravel from the pit. The scraper feeds a continuous belt conveyor which conducts the material to the continuous bucket conveyor, and thence into the bins. The hoist is mounted on a four-wheel truck and is driven by a direct connected gasoline engine.

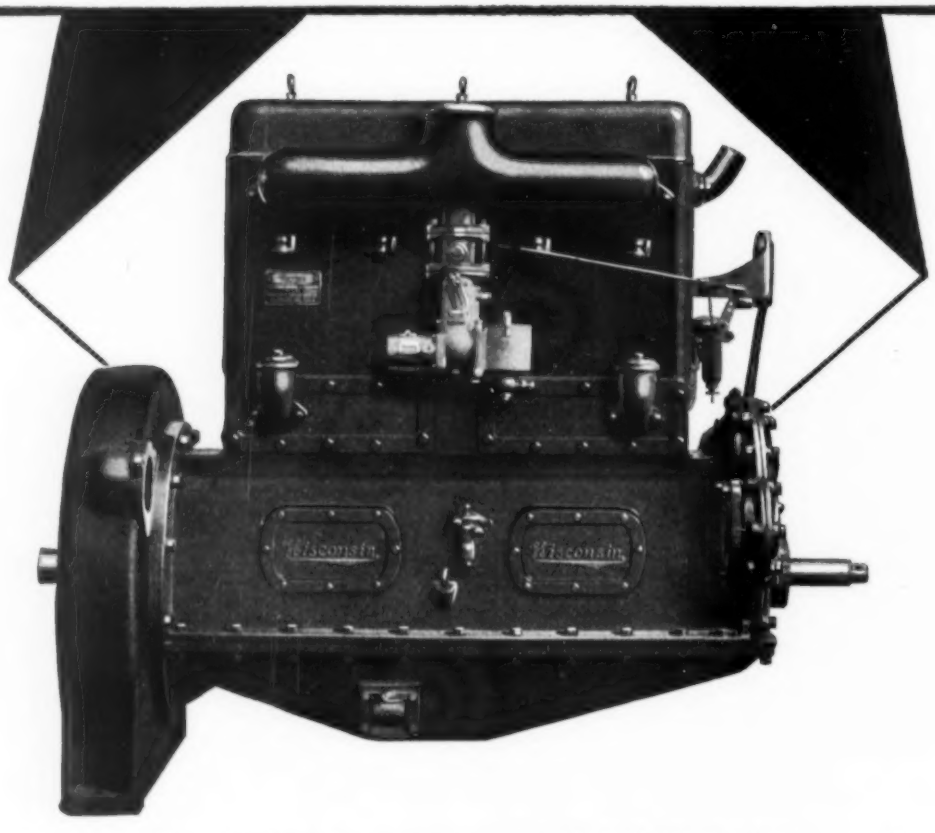
Further information about this outfit may be obtained from the Bakstad Crusher and Equipment Corporation, 122 So. Michigan Avenue, Chicago, Ill.



Bakstad Crusher and Portable Loading Units

MORE POWER per CUBIC INCH

GOOD—All the Way



Good—for all work where "more power per cubic inch" is of value.

Good—where dollar-saving economy and utter dependability are appreciated virtues.

Good as foresighted engineering can plan—as precision manufacture can build—as quality materials can produce.

Not just good enough, but GOOD ALL THE WAY—that's Wisconsin Motors.

WISCONSIN MOTOR COMPANY

MILWAUKEE, WISCONSIN

Built in a full range of Sizes and Fours, from 20 to 150 h.p., for trucks, busses, tractors and construction machinery.

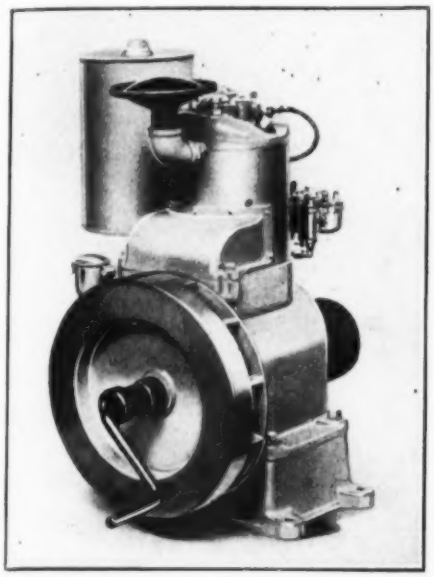
Visit our exhibit at the National Road Show, Cleveland, January 14 to 18, inclusive. Note, also, the manufacturers of heavy equipment who use Wisconsin Motors.

Wisconsin CONSISTENT

Please mention ROADS AND STREETS—it helps.

New Vertical Air-Cooled Engine Announced

The Lauson, vertical air-cooled engine, fills the increasing demand for a motor built on automotive lines, but not too heavy in weight, and with working parts substantial enough to give continuous service. Neat, compact, self-contained construction makes it readily



Showing New Vertical Air-Cooled Engine

applicable to portable units. It also meets the demand of stationary power users for a motor of the higher class design that can be installed on water or light units in a power house or wherever smooth, quiet operation coupled with cleanliness is appreciated.

Specifications

Number of cylinders	1
Bore	2¾ in.
Stroke	3¼ in.
Cycle	4
Speed	900 to 1,400 r.p.m.
Horsepower	1½ at 1,200 r.p.m.
Ignition	Wico type B magneto
Fuel	Gasoline
Carburetor	Tillotson
Flywheel diameter	12 in.
Flywheel face	2¾ in.
Crankshaft bearings	1⅝ in.
Crank pin	1¼ in.
Governor	vertical flywheel type, gear driven, enclosed in dustproof housing, speed adjustable
Height over all	24½ in.
Width over all	21⅝ in.
Pulley	4⅝ in. diam., 3 in. face, fibre
Net weight	170 lb.
Domestic shipping weight	200 lb.
Export shipping weight	260 lb.
Boxed for export	10 in. x 19 in. x 30 in.

Backfiller Winch Combination Announced

A backfiller winch which operates in connection with the McCormick-Deering tractor, has been announced by the Pontiac Tractor Company of Pontiac, Mich., manufacturers of the Pontiac air compressor and the Pontiac Lincoln arc welder. The backfiller is designed to mount with either of the above units and when mounted with the compressor, allows the operations of backfilling and tamping at the same time. These units make a clean one unit designed, self-propelling machine with the draw bar free for hauling other equipment and can be used for a variety of purposes.

The winch has a single drum with clutch and brake and takes its drive from the power drive shaft at the rear of the tractor and is mounted on the frame at this point. The cable coming from the drum is run forward to a point amidship of the frame through a fairway to the backfiller blade. This allows the operator to look directly at the work being done.

The backfiller winch mounted with the compressor on the 10-20 McCormick-Deering tractor will be shown at the road show at Cleveland from the 14th to the 18th of January, in booth NEH-24.

Mr. C. C. Stuart, sales manager of the Pontiac Tractor Company, will be pleased to answer all inquries and send further information.

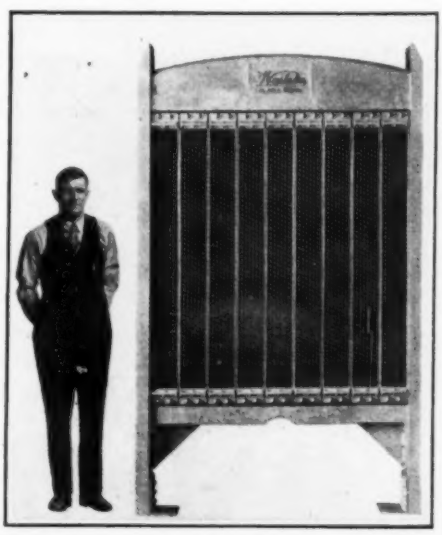
New Type Large Radiator

The Young Radiator Company, announces a new type of radiator for engines with horsepower ranging from 200-300. This unit is a very large one and suitable for cooling these engines for industrial work, in tropical climates and under conditions in the oil fields of the most severe type.

It is built especially for contracting and oil field work and where the conditions render the common automotive type core impractical to use.

These radiators are procurable in several sizes, depending upon the horsepower they are required to cool and the conditions for same, and are furnished either with or without fan equipment.

For further information you can address the Young Radiator Company, Racine, Wisconsin.



The New Young Radiator

Leach Mast Plant

The Leach Company of Oshkosh, Wisconsin, recently announced a new mast plant which is now ready for the market. The Leach mast plant incorporates a number of advantages which effect worthwhile savings. The plant is of all-steel construction and made up of 20-ft. sections. It is equipped with roller bearings, safety devices, and has the use of a double elevator.

Further information may be obtained from Mr. J. P. Landgraf, of Freeze-Vogel-Crawford, Inc., of Milwaukee, Wis., or from the sales manager of the Leach Company of Oshkosh, Wis.

Snow Removal from Highways Facilitated by Improved Equipment

In 36 states, where snowfall is heavy, 111,645 miles of main highways were cleared during the winter of 1927-28, according to reports received by the Bureau of Public Roads of the United States Department of Agriculture.

Ever since the practice of removing snow from highways began in 1921-1922, there has been a steady improvement in machines and equipment available, with an increased amount of equipment every year. In the six years, the use of truck plows has grown from 184 to 3,412; the number of tractor plows from 281 to 1,275. Since both types multiplied more than elevenfold, and since road mileage cleared increased only about fourfold, indications point to a greater completeness of snow removal.

In 17 of the states, all snow removal work was done under the supervision of the state highway departments. In 15 states the work was done by both states and counties or other local governments. In only four states was the work done solely under local control.

Freak Storm Blocks Traffic.—A freak hail storm blocked traffic in the hot summer months in New Mexico according to a recent story from the Highway Department of that state. The hail came on suddenly and with such a force that it washed down the road and onto a bridge where it built up into a solid wall from rail to rail. Tractors and graders were called out to break through, hand efforts failing.

New Mexico Makes Comparative Tests of Road Oils.—The New Mexico Highway Department is now engaged in laying test sections of oil surfacing on U. S. Highway 85 in the northern part of the state. The "turn-over" method of spreading and mixing the oils is being used in all cases the same as it is done on the regular oiling work of the Department. The oils to be tested are Emulsified Bitumuls, Standard and Gilmour.

Make Highways Safer in 1929!

Cyclone Road-Guard holds plunging cars on the road. Reduces the toll of accidents!

TWO HURT WHEN CAR PLUNGES INTO DITCH
Driver of Ford Steers Into East Market Street Ditch to Avoid Hitting Another Car.
Pooser Escapes As Car Plunges Over Embankment
Jersey City Car In Plunge Over River Embankment
A Cole eight automobile, owned and driven by John Starn, of 144 Mallory Avenue, Jersey City, plunged over the embankment at Main and Midland Avenues Saturday night, in an attempt to avoid an accident. No one was hurt, although the car was badly damaged.
AUTO PLUNGES OVER RIVERSIDE VIADUCT
Empty Sedan Runs Down Hill in West 153d Street.
Car Plunges Over Bank

Cyclone "Red Tag" Fence and Products

The Mark of Quality

SEVERAL million more cars on America's highways this year bring added responsibility to highway officials. Every unprotected danger point becomes a more serious menace. The need for protection is more urgent. Old-fashioned wood guards are no longer sufficient. Modern traffic conditions call for more modern safeguards. Cyclone Road-Guard is the last word in highway protection. Adopted as standard by leading highway commissions throughout America.

Cyclone Road-Guard is easy to erect, economical, and involves practically no upkeep expense. Never has been broken through, even by heavy cars at fast speeds. Yields like a giant net, usually prevents serious damage to car or occupants.

Begin planning your 1929 protection program now. Write for specifications on Cyclone Road-Guard and details of how leading highway commissions are building public good will and making highways safer by installing it at highway danger points.

Cyclone Fence Company, *Main Offices:* **Waukegan, Ill.**

Works and Offices: North Chicago, Ill., Greensburg, Ind., Cleveland, Ohio, Newark, N. J., Fort Worth, Texas, Tecumseh, Mich., Oakland, Calif., Portland, Ore.

Pacific Coast Division: Standard Fence Co., Oakland, San Francisco and Los Angeles, Calif.; Portland, Oregon; Seattle, Wash.

Direct Factory Branches in All Principal Cities

Cyclone Road-Guard

REG. U.S. PAT. OFF

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PROTECT HIGHWAYS *against* *Expansion & Contraction Stresses*

SERVICISED
LOOK FOR IT ON ALL PURCHASES

Expansion joints that fail to function properly, that disintegrate with the changing conditions, expose the concrete slabs to rapid erosion and cracking, and soon become unsightly and dangerous to traffic.

Servicised Expansion Joints will not wear away, because they consist of the highest grade of materials. They are carefully manufactured according to specified standards, and are guaranteed to function properly under all conditions.

TYPE B EXPANSION JOINTS is the pioneer, and still the leading 100% expansion material. Its composition is uniform throughout and the 75% of ductile asphalt which makes it extremely weatherproof, also imparts a remarkable plasticity. It acts resiliently to the rapid impacts of traffic and yields readily to the steady pressure of the concrete slabs.

REINFORCED EXPANSION JOINT has become well known among engineers and contractors as an alternate for Type B material. The rigidity obtained by the addition of saturated felt to the sides of a soft plastic core is valuable in handling. The asphalt content is always approximately 80% by weight.

Write us today for full information and prices on Servicised Expansion Joints.

Bridge Flooring (actual wearing surface)
Rail Filler
Rail Plastic
Preformed Waterproofing (needs no protection course) (needs no felts or fabrics)
Highway Crossings (at grade)
Railroad Crossings in pavements
Industrial Flooring for moving loads
Asphalt Planks as a protection to waterproofing
Raggle Blocks or **Flashing Blocks** and **Flashing Strips**

Servicised Products Corp.
Factory and General Offices
6051 West 65th Street
Chicago, Illinois

SERVICISED EXPANSION JOINTS

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***See the Road and Street Catalog & Data Book**

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ROADS and STREETS

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Municipal News and Water Works
Roads and Streets
Tiles and Tile Work
Road and Street Catalog and Data Book
Water Works Catalog and Data Book
General Contractors' Catalog and Data Book

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ONLY THE BARBER-GREENE HAS THE DISC-FEED

AN ADVERTISEMENT NO ONE ELSE CAN WRITE

Of all loader features, none is so important as the Disc-Feed, patented and exclusive to Barber-Greene's three great loaders. The two revolving discs slide beneath the pile of stone, sand, or what have you—or into the bank—pulling, always pulling the materials into the extra-wide buckets. Result: greatest loading speed — no danger of jamming — absolute safety to those about the machine—an almost perfect clean-up. In addition, the new Barber-Greene Spring Overload Release protects against jamming of buckets. These points mean greater efficiency and lower costs. Check them through the booklet, "Loading Layouts." Copies on request.

One reason why Barber-Greene Loaders are famous as Cost Cutters

Barber-Greene Company, 510 West Park Ave., Aurora, Illinois

Disc Feed Barber-Greene LOADERS

Model "25"—1 yard per minute

Model "42"—1¼ yards per minute

Model "28"—wheel mounted

WHERE TO BUY

A classification of machinery and supply manufacturers advertising in the Gillette construction papers. This is for the convenience of contractors, engineers and officials who may wish to secure information about construction equipment and supplies. When writing please mention the name of this magazine.

This index is published as an aid to the reader, but the pubishers assume no responsibility for errors or omissions However Publishers will appreciate receiving omissions and corrections

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Haiss Mfg. Co., Geo., New York City.

Brick, Paving
National Paving Brick Mfgrs., Assn., Chicago.

Brick, Vitrified
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Bridge Rockers
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Garst Mfg. Company, Chicago.

Buckets, Clam Shell
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Williams Co., G. H., Erie, Pa.

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Osgood Company, Marion, Ohio.
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Grasselli Chemical Co., Cleveland, O.
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Solvay Sales Corp., New York City.

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Blaw-Knox Co., Pittsburgh, Pa.

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Carts, Concrete
Insley Mfg. Co., Indianapolis, Ind.
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Bethlehem Steel Co., Bethlehem, Pa.
Central Foundry Co., New York City.
McWane Cast Iron Pipe Co., Birmingham, Ala.
Marion Steam Shovel Co., Marion, Ohio.
U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.

Castings, Street and Sewer
Central Foundry Co., New York City.
U. S. C. I. Pipe & Fdy. Co., Burlington, N. J.
Portland Cement Assn., Chicago.
Universal Port. Cement Co., Chicago.

Cement
Ash Grove Lime & Portland Cement Co., Kansas City, Mo.
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Insley Mfg. Co., Indianapolis, Ind.
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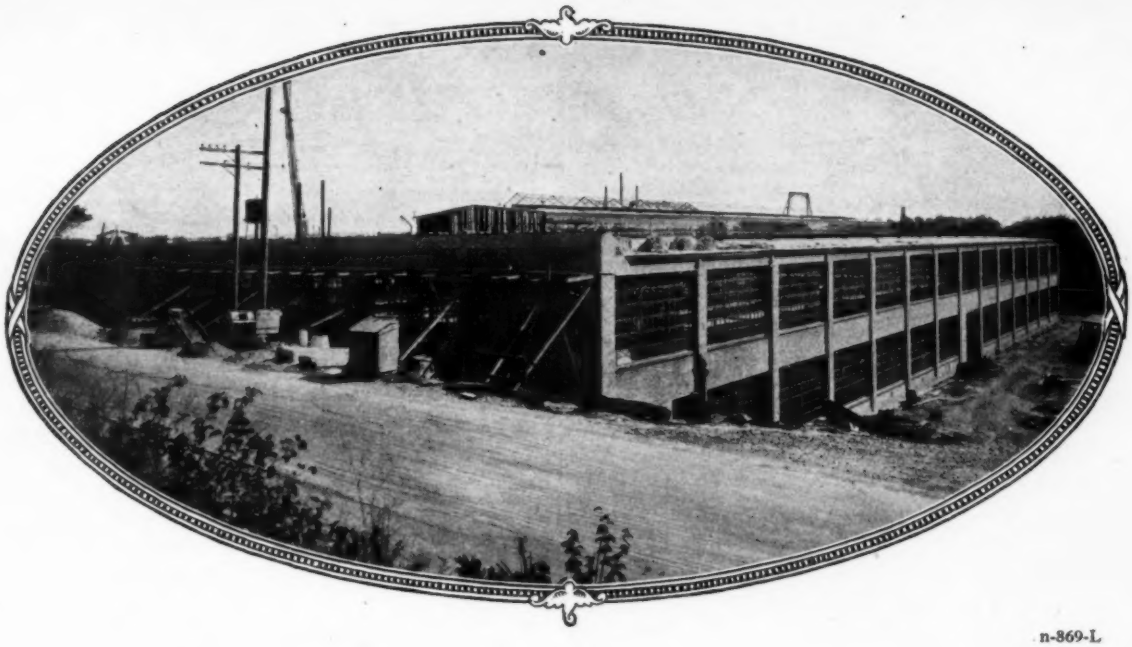

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Austin Western Rd. Mchy. Co., Chicago.
Barber-Greene Co., Aurora, Ill.
Burch Corp., Crestline, O.
Hains Mfg. Co., Inc., Geo., New York City.
Link Belt Co., Chicago.

Loaders, Portable
Hains Mfg. Co., Geo., New York City.
Nelson Iron Wks., N. P., Passaic, N. J.

Locomotives, Gasoline
Fate-Root-Heath Co., Plymouth, O.
Plymouth Locomotive Wks., Plymouth, O.
Geo. D. Whitcomb Co., Rochelle, Ill.

Locomotives, Steam
Porter Company, H. K., Everett, Mass.

Locomotives, Storage Battery
Whitcomb Co., Geo. D., Rochelle, Ill.

Lubricants
Standard Oil Co. of Ind., Chicago.
Standard Oil Co. of N. Y., N. Y. City.

Lumber
National Lumber Mfrs. Assn., Washington, D. C.

Machinery, Power
Chain Belt Company, Chicago.

Magnetos
American Bosch Magneto Corp., Chicago.
Eisemann Magneto Co., New York City.

Maintainer, Road
Austin Western Road Mchy. Co., Chicago.
Lincoln Steel & Forge Co., St. Louis, Mo.

Manhole Covers
Central Foundry Co., New York City.
South Bend Fdy. & Mach. Co., South Bend, Ind.

Manilla Rope
(See Rope, Manilla)

Manometers
Simplex Valve & Meter Co., Philadelphia.

Meter Boxes
N. W. Clark Co., Mattoon, Ill.
Ford Meter Box Co., Wabash, Ind.

Meters, Water, Oil, Gas, Etc.
Buffalo Meter Co., Buffalo, N. Y.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Simplex Valve & Meter Co., Philadelphia, Pa.
Union Water Meter Co., Worcester, Mass.

Meter Repairs
Reading Meter Repair, Co., Reading, Pa.

Mixers, Asphalt
(See Mixers, Hot)

Mixers, Concrete
American Cement & Mach. Co., Keokuk, Ia.
Cement-Gun Co., Chicago.
Construction Mchy. Co., Waterloo, Ia.
Jaeger Machine Co., Columbus, O.
Knickerbocker Co., Jackson, Mich.
Koehring Company, Milwaukee, Wis.
Ransome Concrete Mchry. Co., Dunnellen, N. J.

Mixers, Grout
Ransome Concrete Mchry. Co., Dunnellen, N. J.

Mixers, Mortar
Knickerbocker Co., Jackson, Mich.
Ransome Concrete Mchry. Co., Dunnellen, N. J.

Mixers, Paving
Koehring Company, Milwaukee.

Mixers, Pneumatic
Ransome Concrete Mchry. Co., Dunnellen, N. J.

Motors, Electric
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Motors, Gasoline
Buda Company, Harvey, Ill.
Climax Engineering Co., Clinton, Ia.
Continental Motors Corp., Muskegon, Mich.
Minneapolis Steel & Mchy. Co., Minneapolis, Minn.
Twin City Engineers, Minneapolis, Minn.
Waukesha Motor, Co., Waukesha, Wis.
Wisconsin Motor Mfg. Co., Milwaukee, Wis.

Motor Trucks
(See Trucks, Motor.)

Mowers, Highway
Rawls Mfg. Co., Streator, Ill.

Office Equipment
Burroughs Adding Mach. Co., Detroit, Mich.
Superior Equipment Co., Detroit, Mich.

Packing
Mabbs Hydraulic Packing Co., Chicago.

Paint, Hydraulic
Senet, Solvay Process Co., New York City.

Patching Asphalt
Headley Good Roads Co., Philadelphia.

Pavers
Chain Belt Co., Milwaukee, Wis.
Foote Co., Nunda, N. Y.
Ransome Concrete Mchy. Co., Dunnellen, N. J.
T. L. Smith Co., Milwaukee, Wis.

Pavement Breakers
Chicago Pneumatic Tool Co., New York City.
Ingersoll-Rand Co., New York City.
Sullivan Machinery Co., Chicago.

Paving, Asphalt
Standard Oil Co. of Indiana, Chicago.
Standard Oil Co. of N. Y., New York City.

Paving Blocks, Creosoted Wood
(See Creosoted Block Timber)

Paving, Brick
National Paving Brick Mfgrs. Assn., Chicago.

Paving, Cold Patching
Standard Oil Co. of Indiana, Chicago.
Standard Oil Co. of N. Y., New York City.

Paving Materials, Vitrified Brick
National Paving Brick Mfgrs. Assn., Chicago, Ill.

Penstocks
Blaw-Knox Co., Pittsburgh, Pa.
Connery Company, Philadelphia.

Pile Drivers
Browning Crane Co., Cleveland, O.
Harnischfeger Corporation, Milwaukee, Wis.
Industrial Brownhoist Corp., Cleveland, O.
Link Belt Co., Chicago, Ill.
McKiernan-Terry Drill Co., New York City.
Vulcan Iron Works of Chicago, Chicago, Ill.

Pile Extractors
Vulcan Iron Works of Chicago, Chicago, Ill.

Pile Hammers, Steam
McKiernan-Terry Drill Co., New York City.
Vulcan Iron Works of Chicago, Chicago, Ill.

Piling, Interlocking Steel
Bethlehem Steel Co., Bethlehem, Pa.
Wemlinger, Inc., New York City.

Pipe, Cast Iron
Cast Iron Research Assn., Chicago.
Central Foundry Co., New York City.
Clow, J. B. & Sons, Chicago.
Copper and Brass Research Assn., New York City.
McWane Cast Iron Pipe Co., Birmingham, Ala.
Nat'l Cast Iron Pipe Co., Birmingham, Ala.
U. S. Cast Ir. Pipe & Fdry. Co., Burlington, N. J.
Wood & Co., R. D., Philadelphia.

Pipe, Clay, Vitrified
Clay Products Assn., Chicago.

Pipe, Concrete
Asphalt Concrete Corp., New York City.
Independent Concrete Pipe Co., Indianapolis, Ind.
Lock Joint Pipe Co., Ampere, N. J.

Pipe, Corrugated
Austin Western Rd. Mchy. Co., Chicago.
Independent Concrete Pipe Co., Indianapolis, Ind.

Pipe Cutter
Ellis & Ford Mfg. Co., Detroit, Mich.

Pipe Fittings
Central Foundry Co., New York City.
U. S. Cast Ir. Pipe & Fdy. Co., Burlington, N. J.

Pipe Fusion, Welded
Kern Company, New York City.

Pipe—Gas Stopper
Safety Gas Main Stopper Co., New York City.

Pipe, Ingot Iron
Armco Culvert & Flume Mfrs. Assn., Middletown, O.

Pipe Joint Compounds
Leadite Co., Philadelphia.
Pacific Flush Tank Co., New York City.
Ruberoid Co., New York City.

Pipe Line Accessories
Water Works Equipment Co., New York City.

Pipe, Lock Joint
Lock Joint Pipe Co., Ampere, N. J.

Pipe, Reinforced Concrete
Independent Concrete Pipe Co., Indianapolis, Ind.
Lock Joint Pipe Co., Ampere, N. J.

Pipe, Riveted Steel
Blaw-Knox Co., Pittsburgh, Pa.
Connery & Company, Philadelphia.

Pipe Seal
(See Pipe Joint Compounds)

Pipe, Sewer
Clay Products Co., Chicago.

Pipe Shoes
Marion Malleable Iron Wks., Marion, O.

Pipe, Spiral
Blaw-Knox Co., Pittsburgh, Pa.

Pipe, Spiral, Riveted
Abendroth & Root Mfg. Co., New York City.

Pipe, Storm Sewer
Armco Culvert & Flume Mfrs. Assn., Middletown, O.

Plow, Snow
Rotary Snow Plow Co., Minneapolis, Minn.

Poles, Steel Structural
Blaw-Knox Co., Pittsburgh, Pa.

Pouring Pots
Tanant Mfg. Co., Saratoga Springs, N. Y.

Power Units, Gasoline
Buda Company, Harvey, Ill.
Waukesha Motor Co., Waukesha, Wis.

Pressed Steel Products
Blaw-Knox Co., Pittsburgh, Pa.
Kalman Steel Co., Chicago, Ill.

Pumps, Air Lift
Chicago Pneumatic Tool Co., New York City.
Ingersoll-Rand Co., New York City.
Sullivan Machinery Co., Chicago.

Pumps, Boiler Feed, Steam
Cameron Steam Pump Wks., A. S. (Ingersoll-Rand Co.), New York City.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), New York City.

Pumps, Centrifugal
Aurora Pump Company, Aurora, Ill.

Pumps, Centrifugal and Multi-Stage High Lift
Amer. Well Works, Aurora, Ill.
Cameron Steam Pump Wks., A. S. (Ingersoll-Rand Co.), New York City.
De Laval Steam Turbine Co., Trenton, N. J.
Fairbanks-Morse Co., Chicago.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), New York City.
Keystone Driller Co., Beaver Falls, Pa.
Morris Machine Wks., Baldwinsville, N. Y.
Novo Engine Co., Lansing, Mich.

Pumps, Contractors'
Barnes Mfg. Co., Mansfield, O.
Cameron Steam Pump Wks., A. S. (Ingersoll-Rand Co.), New York City.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), New York City.
La Bour Co., Chicago Heights, Ill.
Novo Engine Co., Lansing, Mich.

Pumps, Deepwell
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Amer. Well Works, Aurora, Ill.
Aurora Pump Company, Aurora, Ill.
Cook, A. D., Lawrenceburg, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Keystone Driller Co., Beaver Falls, Pa.
Novo Engine Co., Lansing, Mich.
Peerless Pump Co., Chicago.
United Iron Wks., Kansas City, Mo.

Pumps, Diaphragm
Novo Engine Co., Lansing, Mich.

Pumps, Dredging and Sand
Ellicott Machine Corp., Baltimore, Md.
Marion Steam Shovel Co., Marion, O.
Morris Machine Wks., Baldwinsville, N. Y.
Norborn Engineering Co., Darby, Pa.

Pumps, Power
Amer. Well Works, Aurora, Ill.
United Iron Wks., Kansas City, Mo.

Pumps, Rotary
Waterous Co., St. Paul, Minn.

Pumps, Sewage
Pacific Flush Tank Co., New York City.

Pumps, Underwriters' Centrifugal
Allis-Chalmers, Mfg. Co., Milwaukee, Wis.
Amer. Well Works, Aurora, Ill.

Pumps, Water Works
Chicago Pneumatic Tool Co., New York City.

Radiators
Young Radiator Co., Racine, Wis.
Modine Mfg. Co., Racine, Wis.

Railroad Ditchers
Bucyrus-Erie Company, Erie, Pa.
Harnischfeger Corporation, Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.

Rails, Relaying
(See Clearing House)

Railway Supplies
Pidgeon, Thomas, Iron Co., Memphis, Tenn.

Reinforcing Bar Couplings
Marion Malleable Iron Wks., Marion, O.

Reinforcing Concrete
(See Conc. Reinforcement)

Reinforcing Metal for Concrete Work
Amer. Steel & Wire Co., Chicago.
Concrete Steel Co., New York City.
Kalman Steel Co., Chicago.
Ryerson & Son, Jos. T., Chicago.

Rivet Busters & Sets
Chicago Pneumatic Tool Co., New York City.

Riveting Machines
Chicago Pneumatic Tool Co., New York City.

Road Builder
Banting Mfg. Co., Toledo, O.

Road Finisher
A. W. French & Co., Chicago.

Road Oils & Preservatives
Grasselli Chemical Company, Cleveland, O.
Solvay Process Company, New York City.
Standard Oil Co. of Indiana, Chicago.
Standard Oil Co. of N. Y., New York City.

Road, Oilers, Pressure
Austin Western Rd. Mchy. Co., Chicago.
Good Roads Mchy. Co., Kennett Square, Pa.

Road Rollers, Gas & Steam
Austin Western Rd. Mchy Co., Chicago.
Buffalo-Springfield Roll. Co., Springfield, O.

Road Router
Ted Carr & Co., Chicago.
Banting Mfg. Co., Toledo, O.
Erie Machine Shops, Erie, Pa.
Etnyre, E. D., Oregon, Ill.
Galion Iron Wks., Galion, O.
Huber Mfg. Co., Marion, O.

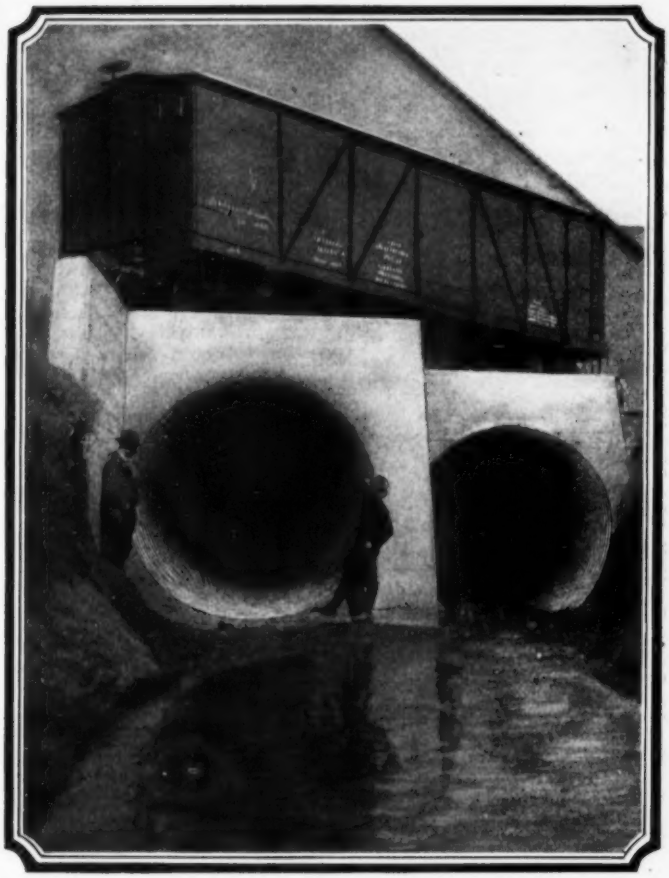
Rolls, Crushing
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Universal Crusher Co., Cedar Rapids, Ia.

Roofing Metal
Truscon Steel Co., Youngstown, O.
Ryerson & Son, Jos. T., Chicago, Ill.

Rope, Manilla
Pidgeon, Thomas, Iron Co., Memphis, Tenn.

Yes—we would like you to mention ROADS AND STREETS.

A Bridge can be both economical and safe!



10-foot Armco culvert installed under railroad in Georgia, 1927

THE greater safety of a culvert installation in comparison with that of a bridge is well known to every highway engineer. It avoids the hazards of the open bridge by providing a continuous fill which absorbs loads and shocks with an intervening cushion of earth.

The ability of Armco Corrugated Pipe to absorb the transmitted loads with its flexible corrugated arch has been definitely proved and explained by the exhaustive tests of the American Railway Engineering Association.*

The simplicity of installation of Armco large-sized pipe affords a decided saving in first cost of bridge construction. What is more, it costs less to maintain—there is no need of periodic inspection—no painting — no re-planking. With Armco corrugated pipe the first cost is the only cost.

An interesting booklet, "Applying Culvert Simplicity to Highway Bridge Problems," gives some valuable facts on economy and safety in bridge construction. Your name and address bring it.

Forty manufacturing plants throughout the United States and Canada assure you immediate service on drainage requirements, no matter where you may be.

ARMCO CULVERT MANUFACTURERS ASSOCIATION
MIDDLETOWN, OHIO

*A complete report of the American Railway Engineering Association tests and findings will be mailed on request.

ARMCO corrugated PIPE

"Look under your roads"

©1928, Armco Culvert Mfrs. Assn., Middletown, Ohio

WHERE TO BUY

Rope, Wire, Transmission Hoisting or Haulage
American Steel & Wire Co., Chicago.
Leschen & Sons Rope Co., St. Louis, Mo.
Page Steel & Wire Co., Bridgeport, Conn.
Roeblings Sons Co., J. A., Trenton, N. J.
Wickwire Spencer Steel Co., New York City.
Williamsport Wire Rope, Williamsport, Pa.

Sand Filtration
Northern Gravel Co., Muscatine, Ia.
Tamms Silica Co., Chicago.

Sash, Steel
Ryerson Steel Co., Chicago.

Saws, Rigs, Portable
Knickerbocker Co., Jackson, Mich.

Scaffolding
Patent Scaffolding Co., New York City.

Schools & Colleges
(See Directory of Engineers)

Scrapers, Dragline
Garst Mfg. Company, Chicago.
Sauerman Bros., Chicago.

Scrapers, Scarifiers, Plows, etc.
Anthony Co., Streator, Ill.
Austin Western Rd. Mchy. Co., Chicago.
Ted Carr Co., Chicago.
Multifoote Co., Nunda, N. Y.
Roderick Lean Co., Mansfield, O.
Russell Grader Mfg. Co., Minneapolis, Minn.
Speeder Mchy. Corp., Cedar Rapids, Ia.
Western Wheel Scraper Co., Aurora, Ill.

Screens, Revolving
Austin Western Rd. Mchy. Co., Chicago.
Haiss Mfg. Co., Geo., New York City.
Smith Engineering Works, Milwaukee, Wis.

Screens, Sand, Gravel & Coal
Austin Western Rd. Mchy. Co., Chicago.
Haiss Mfg. Co., Inc., Geo., New York City.
Link Belt Co., Chicago.
Wickwire Spencer Steel Co., New York City.

Screens, Water Intake
Link Belt Co., Chicago.

Second-Hand Equipment
(See Clearing Section)

Sewage Disposal Apparatus
Link-Belt Company, Chicago, Ill.
Pacific Flush-Tank Co., New York City.
Simplex Ejector and Aerator Co., Chicago.

Sewage Ejectors
Simplex Ejector & Aerator Co., Chicago.
Yeoman Bros. Co., Chicago.

Sharpening Machines, Drill Bit
Ingersoll-Rand Co., New York City.
Sullivan Machy. Co., Chicago.

Sheaves
Haiss Mfg. Co., Inc., Geo., New York City.

Sheets, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson & Son, Joseph T., Chicago.

Sheets, Roofing and Siding
Armco Culvert & Flume Mfrs. Assn., Middletown, O.
Ryerson & Son, Joseph T., Chicago.

Shovels, Crawling Tractors
Thew Shovel Co., Lorain, O.

Shovels, Creeper
Harnischfeger Corp., Milwaukee, Wis.
Industrial Brownhoist Corp., Cleveland, O.

Shovels, Diesel
Bucyrus-Erie Company, Erie, Pa.
Harnischfeger Corporation, Milwaukee, Wis.
Industrial Brownhoist Corp., Cleveland, O.

Shovels, Electric
Bucyrus-Erie Company, Erie, Pa.
Harnischfeger Corporation, Milwaukee, Wis.
Industrial Brownhoist Corp., Cleveland, O.
Keystone Driller Co., Beaver Falls, Pa.
Link Belt Co., Chicago.
Marion Steam Shovel Co., Marion, O.
Thew Shovel Co., Lorain, O.

Shovels, Gasoline
American Hoist & Derrick Co., St. Paul, Minn.
Bay City Dredge Wks., Bay City, Mich.
Bucyrus-Erie Company, Erie, Pa.
Harnischfeger Corporation, Milwaukee, Wis.
Industrial Brownhoist Corp., Cleveland, O.
Insley Mfg. Co., Indianapolis, Ind.
Koehring Company, Milwaukee, Wis.
Link Belt Co., Chicago.
Marion Steam Shovel Co., Marion, O.
Ohio Power Shovel Co., Lima, O.
Speeder Mchy. Corp., Cedar Rapids, Ia.
Star Drilling Mch. Co., Akron, O.
Thew Shovel Co., Lorain, O.
Vergan, Schmidt Co., Champaign, Ill.
Universal Crane Co., Cleveland, O.

Shovels, Steam
Browning Crane Co., Cleveland, O.
Bucyrus-Erie Company, Erie, Pa.
Harnischfeger Corporation, Milwaukee, Wis.
Industrial Brownhoist Corp., Cleveland, O.
Keystone Driller Co., Beaver Falls, Pa.
Marion Steam Shovel Co., Marion, O.
Osgood Company, Marion, O.
Thew Shovel Co., Lorain, O.

Skimmer
Bay City Dredge Wks., Bay City, Mich.
Insley Mfg. Co., Indianapolis, Ind.

Skips Stone
Insley Mfg. Co., Indianapolis, Ind.

Sluice Gates
Dayton Reater & Hoist Co., Dayton, O.

Snow Fences
Metalvane Snow Control Corp., Sioux Falls, S. D.

Snow Loaders
Harber Greene Co., Aurora, Ill.
Haiss Mfg. Co., Geo., New York City.

Snow Plows
Austin Western Road Machy. Co., Chicago.
Good Roads Mchy. Co., Inc., Kennett Square, Pa.
Klauer Mfg. Co., Dubuque, Ia.

Spaders
Sullivan Machinery Co., Chicago.

Spikes, Spirals and Splice Bars
Sweet's Steel Co., Williamsport, Pa.

Spreaders
Universal Road Mchy. Co., Kingston, N. Y.

Spreaders, Ballast
Bucyrus-Erie Company, Erie, Pa.

Sprinklers and Sweepers, Street
Austin Western Rd. Mchy. Co., Chicago.
Universal Road Mchy. Co., Kingston, N. Y.

Standpipes
Blaw-Knox Co., Pittsburg, Pa.
Connery & Company, Philadelphia.
Pittsburgh-Des Moines Steel Co., Pittsburg, Pa.

Steam Purifiers
Blaw-Knox Co., Pittsburg, Pa.

Steel
Inland Steel Company, Chicago.
Truscon Steel Co., Youngstown, O.
Ryerson & Son, Joseph T., Chicago.

Steel Plate Construction
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Co., Pittsburg, Pa.
Connery & Company, Philadelphia.
Inland Steel Company, Chicago.
Pittsburgh-Des Moines Steel, Pittsburg, Pa.
Williams Co., G. H., Erie, Pa.

Steel Rock Drill
Chicago Pneumatic Tool Co., New York City.
Ingersoll-Rand Co., New York City.

Steel, Structural
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Inland Steel Company, Chicago.
Minneapolis Steel & Mchry. Co., Minneapolis, Minn.
Pittsburgh-Des Moines Steel Co., Pittsburg, Pa.

Steel, Tool
Bethlehem Steel Co., Bethlehem, Pa.

Stirrups, Continuous Reinforcing Units
Kalman Steel Co., Chicago.
Ryerson & Son, Jos. T., Chicago.

Stops, Curb, Gooseneck
Muller Co., Decatur.

Stoppers, Water Mains, etc.
Safety Gas Main Stopper Co., New York City.

Street Flushers
Etnyre Co., E. D., Oregon, Ill.

Street Sprinklers
Etnyre Co., E. D., Oregon, Ill.

Surfacer, Highway
Concrete Surfacing Mchy. Co., Cincinnati, O.

Tables and Boards, Drawing
Hamilton Mfg. Co., Two Rivers, Wis.

Tank Car Heaters
Etnyre Co., E. D., Oregon, Ill.

Tanks, Air Compressors
Chicago Pneumatic Tool Co., New York City.

Tanks, Elevated Steel, Water
Pittsburgh-Des Moines Steel Co., Pittsburg, Pa.

Tapes, Steel and Metallic
Hamilton Mfg. Co., Two Rivers, Wis.
Keuffel & Esser Co., Hoboken, N. J.
Lufkin Rule Co., Saginaw, Mich.

Tapping Machines
Muller Co., Decatur, Ill.
Water Works Equipment Co., New York City.

Tar Heaters, Kettles
Honhorst Co., Jos., Cincinnati.

Tarvia
The Barrett Co., New York City.

Tents
Wenzel Tent and Duck Co., St. Louis, Mo.

Testing Laboratories
(See Engineers' Directory)

Thawing Equipment
Aeroil Burner Co., West New York, N. J.

Tin Plate
Bethlehem Steel Co., Bethlehem, Pa.

Tools
H. R. Porter, Everett, Mass.

Tools, Electric
Chicago Pneumatic Tool Co., New York City.

Tools, Pneumatic
Chicago Pneumatic Tool Co., New York City.
Ingersoll-Rand Co., New York City.

Torches, Road
National Carbon Co., New York City.
Toledo Pressed Steel Co., Toledo, O.

Towers, Concrete
(See Hoists, Conc. Tower)

Towers Contractors' Material
Dravo Equipment Co., Pittsburgh, Pa.

Towers, Radio
Blaw-Knox Co., Pittsburg, Pa.

Towers, Transmission
Blaw-Knox Co., Pittsburgh, Pa.

Towers, Tubular Steel
Dravo Equipment Co., Pittsburg, Pa.

Track, Industrial & Portable
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson & Son, Jos. T., Chicago.

Traction, Crawling Type
Buckeye Tract. Ditcher Co., Findlay, O.
Trackson Co., Milwaukee.

Tractors
Bates Mfg. Co., Joliet, Ill.
Case, J. I., Threshing Machine Co., Racine Wis.
Caterpillar Tractor Co., San Lanardo, Calif.
Cleveland Tractor Co., Cleveland, O.
International Harvester Co., Chicago.
Minneapolis Steel & Mchry. Co., Minneapolis, Minn.

Tractor Scraper
Roderick Lean Co., Mansfield, O.

Trailers
Lee Trailer & Body Co., Plymouth, Ind.
Martin Trailer Co., Westfield, Mass.
Truehauf Trailer Co., Detroit, Mich.
Rogers Bros. Corp., Albion, Pa.

Traffic Marker
Traffic Marker Corp., New York City.

Tramways, Overhead
Harnischfeger Corporation, Milwaukee, Wis.

Transits and Levels
Buff & Buff Mfg. Co., Boston, Mass.
Kern & Co., New York City.
Warren Knight Co., Philadelphia.

Transmission & Machinery Power
Link Belt Co., Chicago, Ill.

Treads, Safety
Blaw-Knox Co., Pittsburg, Pa.
Concrete Steel Co., New York City.
Ryerson & Son, Jos. T., Chicago.

Treads, Traffic Steel (Bridges)
Central Iron & Steel Co., Harrisburg, Pa.
Wood, Iron & Steel Co., Alan, Philadelphia, Pa.

Trenchers
Bay City Dredge Wks., Bay City, Mich.
Harnischfeger Corp., Milwaukee, Wis.
Parsons Co., Newton, Ia.

Trench Braces
(See Braces, Trench)

Trucks
Federal Motor Truck Co.
General Motors (Chevrolet), Detroit.
Graham Bros., Detroit, Mich.
Hug Co., Highland, Ill.
Indiana Truck Corp., Marion, Ind.
International Harvester Co., Chicago.
Mack Trucks, Inc., New York City.
Reo Motor Car Co., Lansing, Mich.
Selden Truck Corp., Rochester, N. Y.

Trusses, Steel, Roof
Concrete Steel Co., New York City.

Tunnel Liner Plates
Blaw-Knox Co., Pittsburgh, Pa.

Turbines, Hydraulic Impulse and Reaction
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Turbines, Steam
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
De Laval Steam Turbine Co., Trenton, N. J.

Turntables
Blaw-Knox Co., Pittsburgh, Pa.
Western Structural Co., Moline, Ill.

Underwriters, Water Company's
C. L. Ohrstrom & Co., New York City.

Unloaders, Car & Wagon
Haiss Mfg. Co., Geo., New York City.
Link Belt Co., Chicago.

Valves, Air, Water, Steam and Gas
Golden Anderson Valve Specialty Co., Pittsburg, Pa.
Simplex Valve & Meter Co., Philadelphia.

Valves, Altitude
Golden Anderson Valve Specialty Co. Pittsburgh, Pa.

Valves, Angle, Check, Gate and Globe
Golden Anderson Valve Specialty Co., Pittsburgh, Pa.
Simplex Valve & Meter Co., Philadelphia.

Valves, Automatic
Golden Anderson Valve Specialty Co., Pittsburgh.

Valves, Compounding
Union Water Meter Co., Worvester, Mass.

Valves, Float
Golden Anderson Valve Specialty Co., Pittsburg, Pa.

Valves, Gate
Columbian Iron Wks., Chattanooga, Tenn.
Darling Valve & Mfg. Co., Williamsport, Pa.

Valves, Regulating
Golden Anderson Valve Specialty Co., Pittsburg, Pa.
Simplex Valve & Meter Co., Philadelphia.

Valves, Return
Golden Anderson Valve Specialty Co., Pittsburg, Pa.

Valves, Safety
Golden Anderson Valve Specialty Co., Pittsburg, Pa.

Valves, Sluice
Coldwell Wilcox Co., Newburg, N. Y.

Valves, Water Works
Columbian Iron Wks., Chattanooga, Tenn.
Darling Valve & Mfg. Co., Williamsport, Pa.
Golden Anderson Valve Co., Pittsburg, Pa.

Wagons, Dump
Austin Western Rd. Mchy. Co., Chicago.

Wagons, Dump, Auto
Austin Western Rd. Mchy. Co., Chicago.
Ditwiler Mfg. Co., Galion, O.

Washers
Smith Engineering Works, Milwaukee.

Waste Gates and Hoists
Dayton Reater & Hoist Co., Dayton, O.

Water-Main Cleaning
Nat'l Water Main Clean. Co., New York City.

Waterproofing Compounds and Materials
Ceresit Waterproofing Corp., Chicago.
National Asbesto-o-Phalt Corp., Chicago.

Water Softeners
International Filter Co., Chicago.
Roberts Filter Mfg. Co., Darby, Pa.
Zeolite Chemical Co., New York City.

Water Works Supplies
Water Works Equip. Co., New York City.

Welded Fabric
Truscon Steel Co., Youngstown, O.
Wickwire Spencer Co., New York City.

Well Drilling Machinery
Amer. Well Works, Aurora, Ill.

Wells, Concrete
F. Thorpe, E. St. Louis, Ill.

Wells, Water
McCarthy Well Co., Minneapolis, Minn.

Wheels, Steel
French & Hecht, Davenport, Ia.

Winches, Ship, Hand, Steam and Electric
Lidgerwood Mfg. Co., Elizabeth, N. J.

Window Sash Steel
Ryerson & Son, Jos. T., Chicago.

Wire Fence
American Steel & Wire Co., Chicago.
American Wire Fence Co., Chicago.
Cyclone Fence Co., Waukegan, Ill.
Page Steel & Wire Co., Bridgeport, Conn.

Wire, Mesh Reinforcing
American Steel & Wire Co., Chicago.
Truscon Steel Co., Youngstown, Ohio.
Wickwire Spencer Steel Co., New York City.

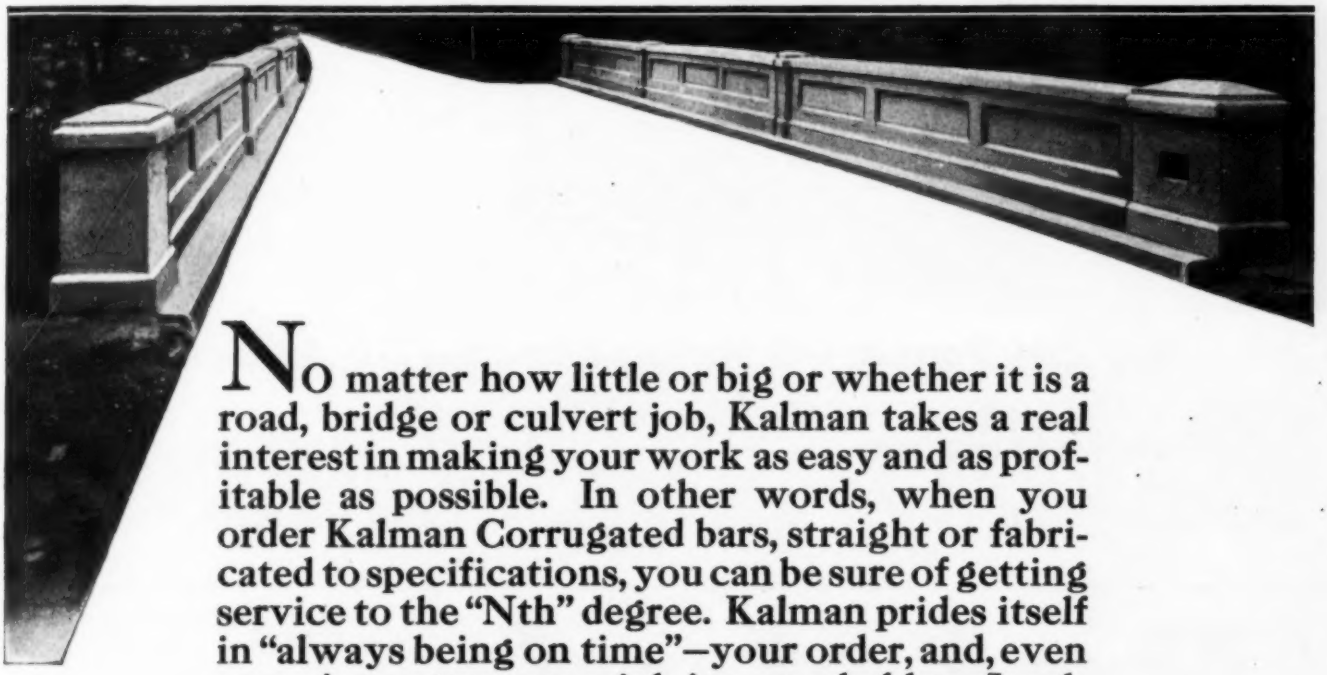
Wire Rope
(See Rope, Wire)

Wire Rope, Fittings
Roebling's Sons Co., J. A., Trenton, N. J.

Wire Rope, Slings
Roeblings Sons Co., J. A., Trenton, N. J.

Do you mention ROADS AND STREETS when writing? Please do.

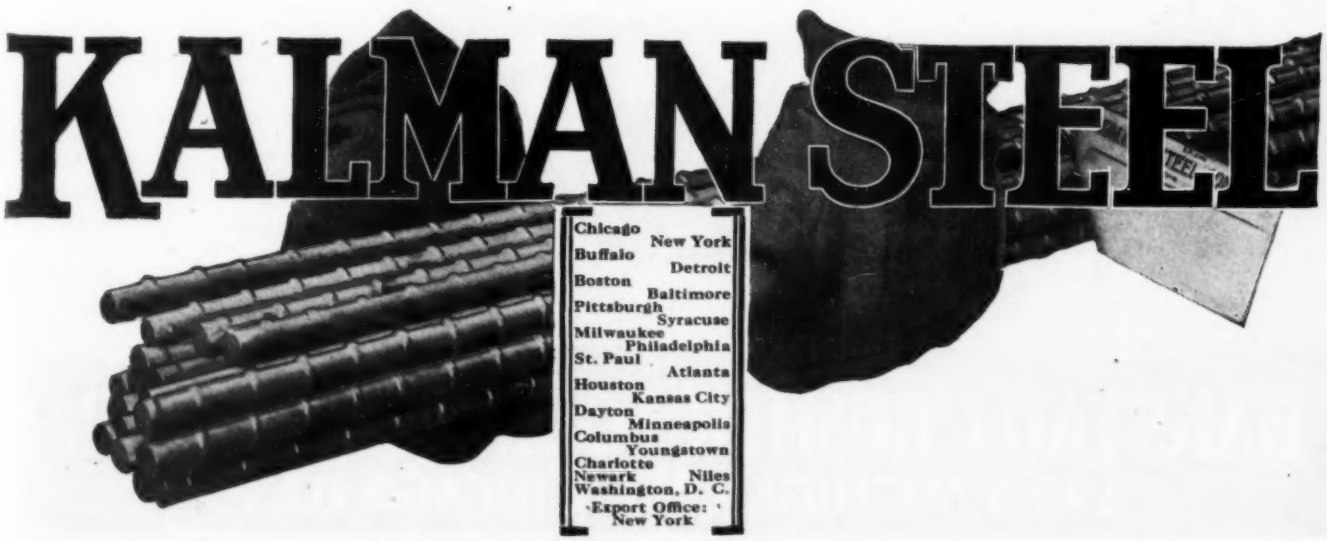
We Guard Your Margin of Profit On Every Road, Bridge or Culvert Job

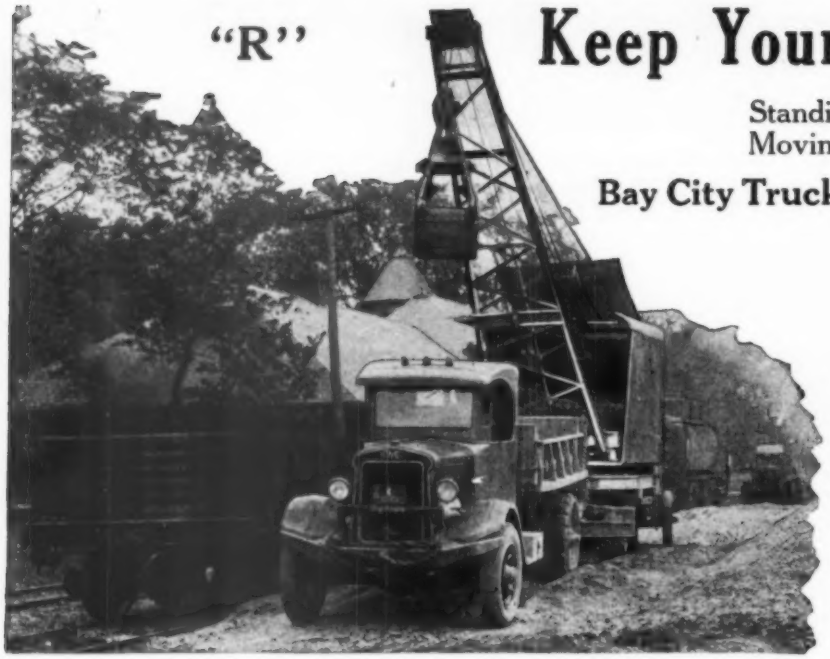


NO matter how little or big or whether it is a road, bridge or culvert job, Kalman takes a real interest in making your work as easy and as profitable as possible. In other words, when you order Kalman Corrugated bars, straight or fabricated to specifications, you can be sure of getting service to the "Nth" degree. Kalman prides itself in "always being on time"—your order, and, even more important, your job, is never held up. In addition to cutting and bending the reinforcing as specified by you, Kalman tags every bundle of bars for ready identification. Placing is easier and faster. In this way Kalman guards your margin of profit—always. Write us about your next job.

KALMAN STEEL COMPANY

KALMAN STEEL





"R"

Keep Your Trucks Moving

Standing trucks make for losses
Moving trucks make for profits

Bay City Truck Cranes Keep Them Moving

"We unloaded 126 cars of gravel into trucks in 12 days."

Highway Dept.

Truck stands 3½ minutes to be loaded by Bay City Truck Crane.

Same truck stands 16 minutes to be loaded by hand.

What are the profits at the rate of $25 per day per truck?

Figures on one job show clear profits of $76 per day for the Bay City Truck Crane.

Bay City Foundry & Machine Co., Bay City, Michigan

Bay City Full revolving Motor Truck Cranes

Bakstad Patented 3-Jaw Crusher

Holland Township Supervisors state the following, "We believe that Bakstad is the only crusher on the market today that will crush one-inch material or finer in one operation."

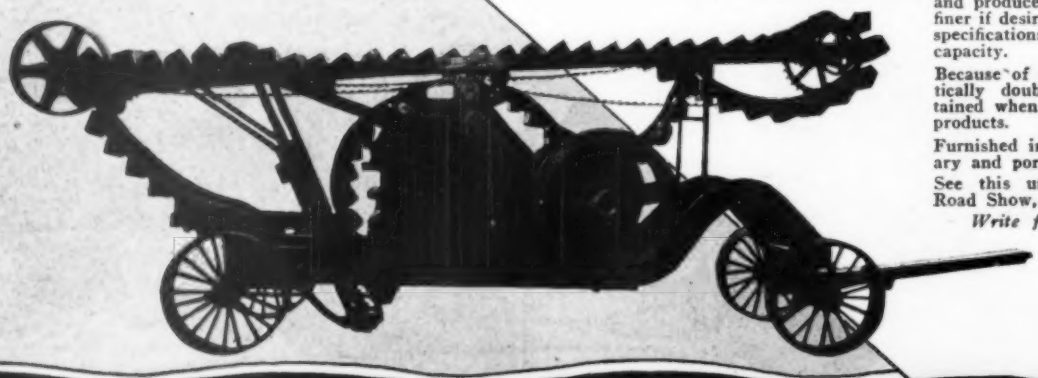
With the Bakstad 3-Jaw Crusher which is really 3 crushers in one, it is possible to feed your large material to one machine and produce a one-inch product (or finer if desired) as required by most specifications, without sacrificing capacity.

Because of the double outlet, practically double the capacity is obtained when set to produce coarser products.

Furnished in several sizes, stationary and portable.

See this unusual crusher at the Road Show, Space S-E-H-2.

Write for full particulars.



BAKSTAD CRUSHER EQUIPMENT CORP.

122 S. MICHIGAN, AVE. CHICAGO, ILL.

Please mention ROADS AND STREETS—it helps.

Better Roads Thru Westeeco Steel
Western Crucible Steel
Using Westeeco Steel Exclusively
Westeeco Steel plays its part in Stockland Road Graders
Crucible Steel Casting Co
Ask the Dump Truck Driver on the
WESTEECO STEEL
St. Paul
Western Crucible Steel Casting Co
2833 GRAND AVENUE
MINNEAPOLIS, MINN.

Northwest Manufacturers are sold on

WESTEECO STEEL CASTINGS

WESTEECO PRODUCTS

Westeeco is the same fine steel we use in manufacturing Westeeco Dipper Teeth. Its unusual strength and ability to withstand abrasive wear make Westeeco's the outstanding Dipper Teeth.

THE Hydraulic Hoist Mfg. Co., of St. Paul, the Stockland Road Machinery Co., of Minneapolis, the C. D. Edwards Co., of Albert Lea, the Lincoln Road Machinery Co., of Omaha, and the Greiman Ditcher Co., of Garner Iowa, are but a few of the prominent manufacturing concerns who specify Westeeco Steel for their castings.

Road Machinery Manufacturing Companies, particularly, are specifying Westeeco Steel because they have found that Westeeco castings will stand up longer under heavy road usage.

If the castings in the article you manufacture are subject to extreme strain or abrasive wear it will pay you, also, to investigate Westeeo Steel.

Western Crucible Steel Casting Co

2833 GRAND AVENUE **MINNEAPOLIS, MINN.**

The Most Economical
Highway and Marine Beacon
THE NEW
EVEREADY PORTABLE FLASHER

IT COSTS, on the average, $50 a year to maintain the ordinary red lantern burning kerosene oil.

The new Eveready Portable Flasher costs $10 a year for the Eveready Columbia Dry Batteries necessary to keep it operating steadily.

This is a clear saving of $40 per year. As a matter of fact, the saving will be greater, for the superior warning power of the intermittent flash, and the complete reliability of the flasher, make it possible for one to displace several oil lanterns.

Thus the higher first cost of the flasher is soon covered by the savings it makes possible.

The Eveready Columbia Dry Batteries which furnish current for operation are the standard six-inch size, available everywhere for replacement. When the flasher is operated continuously, a set of Eveready Columbias should last two months. This remarkable life is due to the fact that the intermittent character of the load has been carefully calculated to get the longest possible battery service.

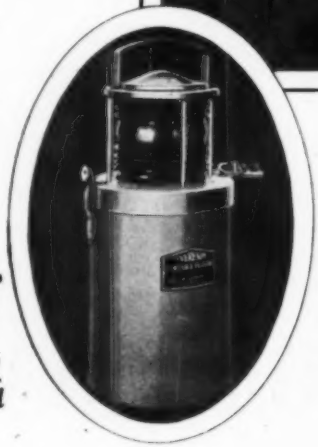
NATIONAL CARBON CO., Inc.
New York, N. Y.

Branches
Atlanta Chicago Kansas City
Long Island City San Francisco

Unit of Union Carbide and Carbon Corporation

UCC

EVEREADY
TRADE MARK
PORTABLE FLASHER
—dry battery operated



SPECIFICATIONS

Height, 16 inches; diameter of base, 7 inches; weight, including batteries, 16½ lbs. The Eveready Portable Flasher is entirely automatic. Needs no attention other than to replace batteries at intervals of two to three months. Requires four standard Eveready Columbia 6-inch dry cells connected in series to deliver 6 volts. Extra 6-volt Eveready-Mazda Lamp No. 1135 inside battery housing. Battery compartment constructed of seamless steel attractively finished in red. Top of flasher cadmium plated for weather protection. Heavy Fresnel type red glass lens. Padlock for battery compartment with an extra long hasp so that the device can be chained. This flasher is of rugged construction throughout and entirely weather-proof.

Please mention ROADS AND STREETS—it helps.

SERVICE

NEEDED seldom . . . . Available always and everywhere . . . . Skilled, prompt and at low cost . . . .

That is the truck owner's estimate of what Repair Service should be . . . . That is the Repair Service that owners of Graham Brothers Trucks depend upon, *and know they can depend upon,* everywhere.

These fast, powerful, sturdy trucks—in sizes to fit 96% of all hauling needs—are built by Dodge Brothers to make money for their owners year after year, mile after mile. This objective guides every manufacturing step—from design and selection of materials to final inspection.

Then, after the truck is at work, the world-wide Dodge Brothers Dealer organization stands ever ready *to keep it at work.*

The never-failing ability of Graham Brothers Trucks to work well, work at low cost and keep on working, accounts for the fact that, even with tremendous production, orders continue to keep ahead of the builders.

PRICES

MERCHANTS EXPRESS —110" wheelbase	$ 665
COMMERCIAL TRUCK —120" wheelbase	775
1¼-TON—130" wheelbase	995
1¼-TON—140" wheelbase	1065
1¾-TON—150" wheelbase	1345
1¾-TON—165" wheelbase	1415
2-TON—150" wheelbase	1545
2-TON—165" wheelbase	1615
3-TON—135" wheelbase	1745
3-TON—165" wheelbase	1775
3-TON—185" wheelbase	1845

Chassis f. o. b. Detroit

GRAHAM BROTHERS TRUCKS

BUILT BY TRUCK DIVISION OF DODGE BROTHERS

SOLD AND SERVICED BY DODGE BROTHERS DEALERS EVERYWHERE

See us at the

Three Years in the Field —First Year at the Show

SEE this new-day shovel that was thoroughly tested and proven in the field in all kinds of work and under every condition you meet with, for a period of nearly three years before it was placed on the market just one year ago. Compare it with every other 1¼ yard shovel made — point for point — and see for yourself how the Lima "101" far excels even your highest ideals of what a shovel should be to meet your demands for less operating costs and greater profits.

There is nothing old-fashioned about the Lima "101" — it's new from crawlers to dippers — new in design, new in principle and years ahead with features that give it 25% greater speed at 20% to 25% saving in fuel.

Nothing else is like the Lima "101" and we want you to make a thorough inspection of the machine to make this decision for yourself — to see how far the largest plant in the world manufacturing power shovels has gone to give you exactly the excavator you want.

Besides offering you an excavator which will increase your profits, the important feature of service has not been overlooked, and now, Lima "101" shovels, draglines, clamshells and drag-shovels as well as repair parts can be shipped promptly, out of stock, from ten strategic points throughout the country.

LIMA "101" DEALERS

Standard Power Equipment Company
Birmingham, Alabama

The Tractor Equipment Co., Inc.
701 South Broadway
Denver, Colorado

The Ohio Power Shovel Co.
1250 Straus Building
Chicago, Illinois

Johnson-Beckwith Equipment Co.
316 East 3rd Street
Davenport, Iowa

Stiles-Murray, Inc.
213 Securities Bldg.
Des Moines, Iowa

Hooper Equipment Co.
523-527 E. Washington St.
Indianapolis, Indiana

Buckmaster-Luck-Malochee, Inc.
617 Common Street
New Orleans, La.

Lake Shore Machinery Co.
Muskegon, Michigan

The Mamer Co.
Benton Harbor, Michigan

Alan G. Cary & Company
204 Endicott Building
St. Paul, Minnesota

Walter A. Zelnicker Supply Company
511 Locust Street
St. Louis, Missouri

The Ohio Power Shovel Co.
Room 706, 30 Church St.
New York, N. Y.

The Wheeler-Murray Co.
329-331 Ellicott St.
Buffalo, New York

J. C. McDonald
2104 Webster Street
Omaha, Nebraska

The C. Taylor Handman Co.
Linwood Ave. and P.C.C. & St. L. Ry.
Cincinnati, Ohio

The Day & Maddock Co.
8201 Almora Ave., S. W.
Cleveland, Ohio

Universal Supply & Machinery Company
201 South Houston Street
Tulsa, Oklahoma

Swank Hardware Company
Main & Bedford Sts.
Johnstown, Pennsylvania

The Richman-Crosby Co.
223 South Front Street
Memphis, Tennessee

Brown-Craven Equipment Company
706 Manning Street
Chattanooga, Tennessee

Fort Worth Well Machinery & Supply Co.
1707 Main Street
Fort Worth, Texas

South Texas Implement & Machinery Co.
908 Wood Street
Houston, Texas

Richmond Machinery and Equipment Company
204 Broadway National Bank Bldg.
Richmond, Virginia

Fred T. Kern Company
650-654 Killian Place
Milwaukee, Wisconsin

THE OHIO POWER SHOVEL COMPANY

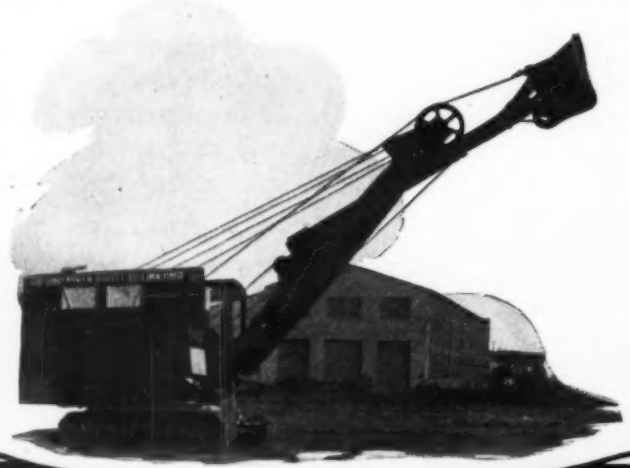
Western Offices
1250 Straus Building
CHICAGO, ILL.

LIMA, OHIO, U. S. A.

Eastern Offices
30 Church Street
NEW YORK, N. Y.

The Gas Shovel

The Lima "101" Gas Shovel is equipped with a Waukesha Motor of 92 H. P. at 850 R.P.M. (Ricardo head) Electric Self-Starter, Batteries and 70 gallon fuel tank. (Weight complete 75,000 lbs.)



The Diesel Shovel

The Lima "101" Diesel Shovel is equipped with a Buda M. A. N. Diesel Motor of 94 H. P. at 850 R. P. M. with gas engine starter and batteries, and 70 gallon fuel tank. (Weight complete 78,000 lbs.)

There are 58 Timken Roller Bearings in the Lima "101," the only machine fully Timken equipped—a roller bearing at every vital bearing point. It's the elimination of friction that insures the tremendous power and negligible maintenance expense in Lima "101."

The pedestals supporting main machinery are through bolted to upper frame casting at bottom and at sides of lugs cast integral. Positive safeguard against end and sidethrust; no vibration; no misalignment of bearings.

All shafts supporting levers are squared at sections to which levers are attached. No lost motion as with worn keyed or slotted round shafts. No detail overlooked to make Lima "101" the quality machine.

Do you mention ROADS AND STREETS when writing? Please do.

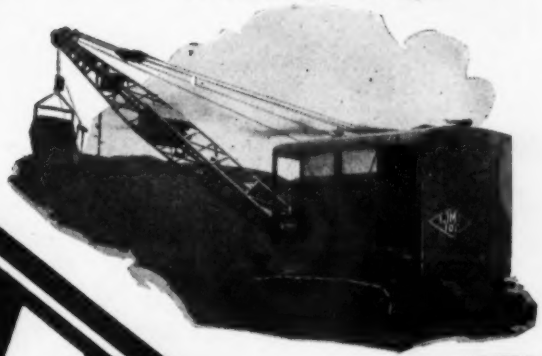
Road Show

Shovel

Compare the Working Ranges

Dragline

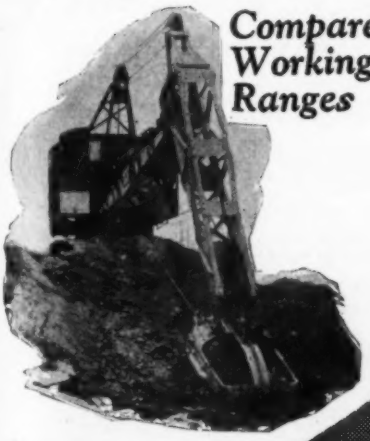
Compare the Working Ranges



LIMA "101"

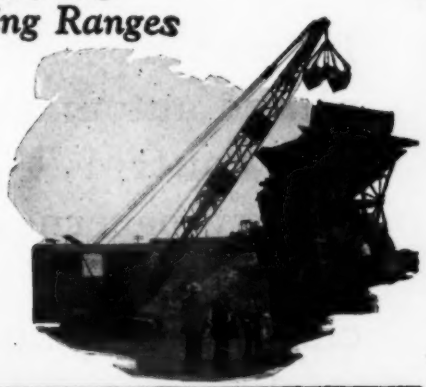
Drag Shovel

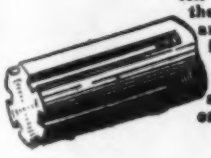
Compare the Working Ranges



Clamshell

Compare the Working Ranges





All main shafts on which there are sliding members are splined for accuracy in fit and positive delivery of power to all motions. No troublesome and unreliable keys or slots.

The Dipper handle is pressed steel; not a single bolt or rivet used in its construction; the most positive assurance against all warping, splitting, bending or breaking.

The patented boom is pressed steel, requiring less than 50% of the bolts and rivets used in ordinary booms. Unlimited manufacturing facilities are responsible for this astonishing advance in boom construction.

KOEHRING

Yes!

Know the Koehring!

YES—the new Koehring is new from charging skip to boom tip!

In speed of operation—simplified automatic actions and control — in swift, hungry eagerness in taking materials into the charging skip and putting quality concrete on the subgrade, the new greater Koehring is beyond all question a new mighty *Master Money-Maker* for the Paving Contractor!

Also, in the mechanical detail and Koehring advanced Heavy Duty Construction it is the super *dreadnaught* of pavers!

KOEHRING COMPANY MILWAUKEE WISCONSIN

PAVERS, MIXERS—GASOLINE SHOVELS, CRANES AND DRAGLINES

Sales Offices and Service Warehouses in all principa icities

Foreign Dept., Room 579, 50 Church St., New York City.
Mexico, F. S. Lapum, Cinco De Mayo 21, Mexico, D. F.

KOEHRING HEAVY DUTY

A4950-I

Greater working capacity *per* dollar of investment··

Small contractors and big ones, too, find the Buckeye *Utility* Crane highly profitable for many odd construction jobs for which heavier and less adaptable equipment is not economical.

Speed—both in operation and traveling—gives it a flexibility that is invaluable for loading, unloading and shifting aggregates, as well as for all crane service within its capacity.

Chief of many operating features that contribute to this Crane's profitable performance are these: Full revolving; slow-speed, heavy-duty gasoline power unit; fast hoisting and swinging speeds; all gears of electric steel, with machine-cut teeth, and heat treated; Alemite pressure lubrication; Timken roller bearings, and Alligator (crawler) traction, each wheel driven separately and having a brake for control when working on steep grades.

AMERICAN ROAD BUILDERS' ASSOCIATION
1929 CONVENTION and ROAD SHOW
JANUARY 14 TO 18 INCLUSIVE
CLEVELAND OHIO

This rugged little *Utility* Buckeye, with its diversified ability as Backfiller, Clamshell, Crane, Ditcher, Dragline and Truck-Crane, sells for only $4750 f. o. b. factory, without bucket or cab.

You can see it at the 1929 American Road Show where there will be a comprehensive Buckeye exhibit.

THE BUCKEYE TRACTION DITCHER COMPANY

Findlay, Ohio

There's a Buckeye Sales and Service Office Near You

for over thirty years

Buckeye

Announcing

From the bottom of the crawler to the teeth of the dipper, the Type 450 is a real 1¼ yard shovel built for real service and honest work

Gasoline for Power
Electricity for Flexibility

MAR

Please mention ROADS AND STREETS—it helps.

the Type 450 GAS-ELECTRIC

POINTING TO BIGGER PROFITS

A Fast, Powerful and Sturdy 1¼ Cubic Yard Gas-Electric

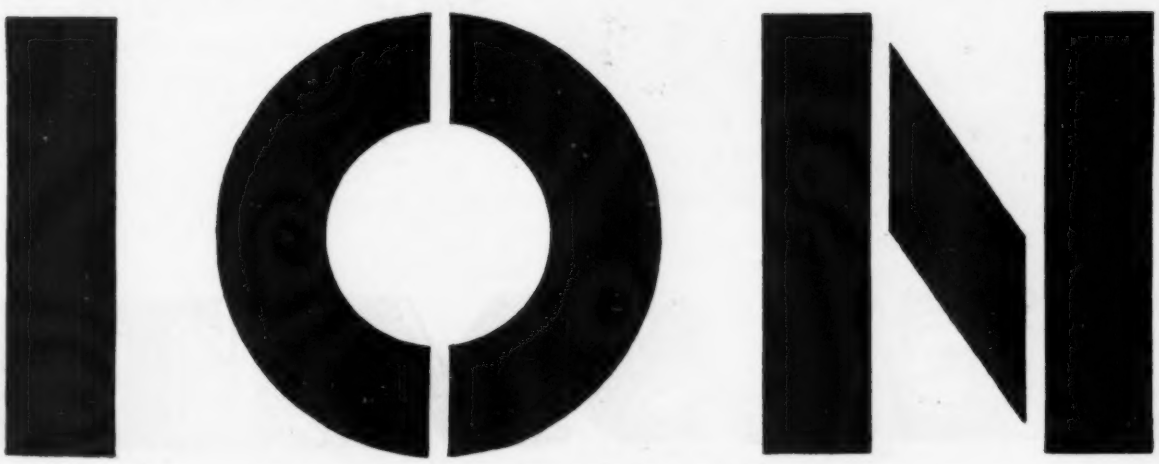
THERE is a fast growing preference for the Gas-Electric—a preference made possible only by the successful performance of machines now in service. Shovel users are rapidly becoming acquainted with its flexibility and good performance and these have resulted in repeated requests for the 1¼ cu. yd. size.

With individual motor drives for each motion the shovel performs like a steam machine and by the elimination of clutches the shovel maintenance is reduced—resulting in lower unit costs of handling material and in greater profit to the user.

THE MARION STEAM SHOVEL COMPANY
MARION, OHIO, U. S. A.

28054

1¼ yd. dipper — 22 ft. boom — 15 ft. dipper handle



What *makes a* Gravel Plant Efficient?

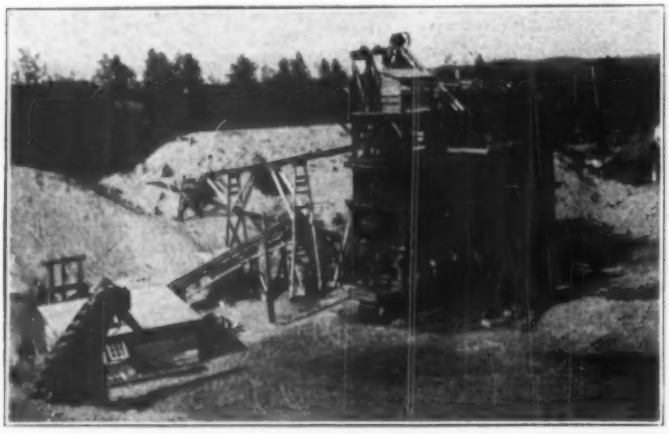
(1) A Steady Flow of Aggregate. The conveyors and screens should not be overloaded sometimes and empty others. The Telsmith Plate Feeder is adjustable for any yardage and regulates the flow accurately—increases output, improves the product, cuts the cost per yard.

(2) Proper Washing Equipment. The Telsmith Heavy Duty Washing Screen scrubs and washes in a single cylinder. It turns out an exceptionally clean product—economically—saving head room, floor space and water.

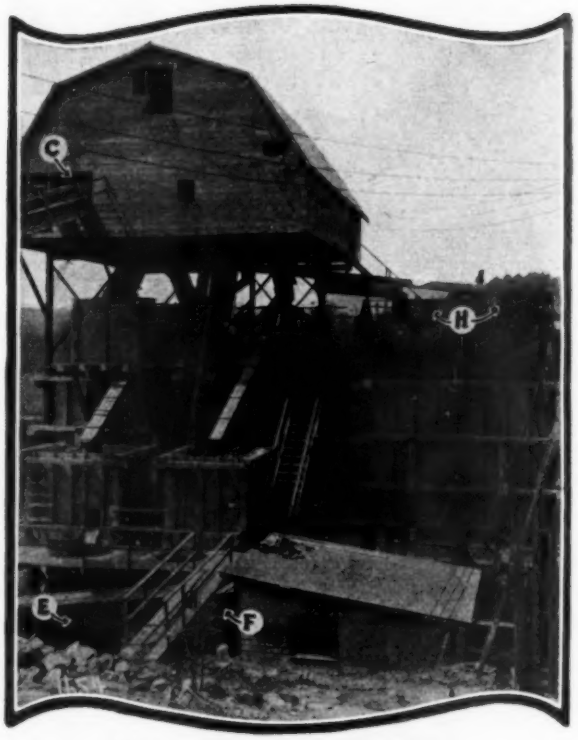
(3) Dependable Crushers. The Telsmith Crusher is ideal for crushing large, smooth, hard gravel boulders. Its famous "parallel pinch" grips them firmly, without slippage—crushing starts the moment they enter the bowl. It has a **steel** frame, **steel** crown and unbreakable shaft, all three guaranteed against breakage even by tramp iron.

(4) Sand Tanks that Discharge Clean, Thoroughly Dewatered Sand. Telsmith Sand Tanks do this—**automatically**—all day and every day, without supervision, labor or power. Their product contains less than 5% free water.

(5) The Service Behind the Equipment. This is most important, for the various units must be balanced and combined, with the proper arrangement of drives and chutes.



Plant of Anton Miench, Iron Mountain, Mich.



Madison Sand & Gravel Corp.
Solsville, N. Y.

Telsmith Balanced Service is the result of twenty years' experience. Telsmith engineers have many highly efficient and profitable gravel plants throughout the country to their credit. Telsmith's new and modern factory, with its remarkable facilities, manufactures all equipment, from crushers to bin gates. Telsmith's willingness and ability to take full and undivided responsibility and to **guarantee results** has earned the confidence of the gravel plant industry. Write for descriptive Bulletin G. P. 3. No cost or obligation, of course.

SMITH ENGINEERING WORKS

82 Capitol Drive, Milwaukee, Wis.

Canadian Representatives:
Canadian Ingersoll-Rand Co., Montreal, P. Q.

11 West 42nd St. New York City	716 Builders' Bldg. Chicago, Ill.	Harrison Bldg. Philadelphia, Pa.
K. B. Noble Co. Hartford, Conn.	Beckwith Mchy. Co. Pittsburgh, Pa.	Tower Mchy. Co. Cleveland, O.
Milburn Mchy. Co. Columbus, Ohio	Knox Eng. & Eq. Co. Indianapolis, Ind.	Brandeis M. & S. Co. Louisville, Ky.

G.P. 12

TELSMITH

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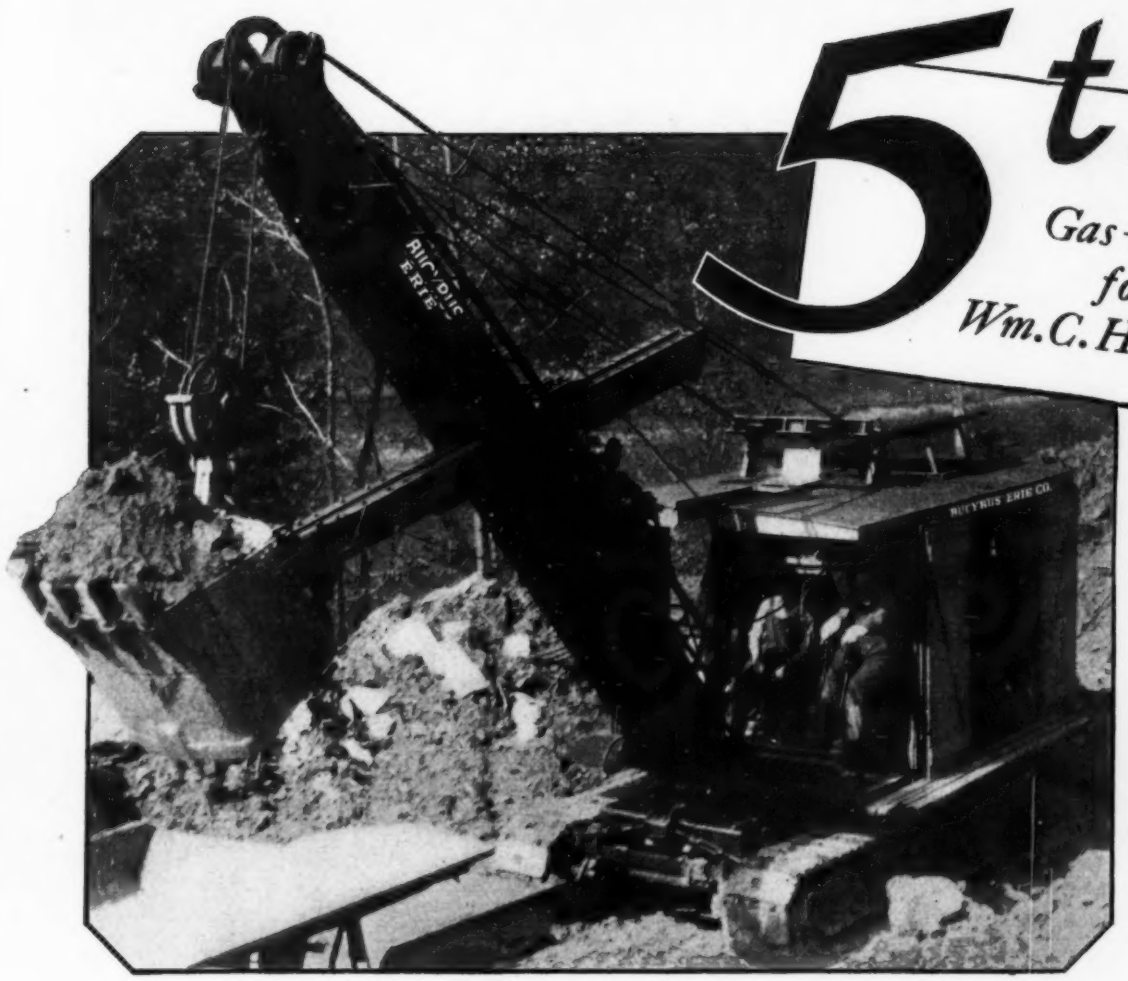


5th

Gas + Air for Wm. C. Horn Co.

On Pennsylvania's biggest highway job

If you have anything whatever to do with Pennsylvania road work, you undoubtedly know all about the Horn concern—William C. Horn Co. of Lock Haven, Pa., who have built many miles of highways in and around Pennsylvania, and are now handling the biggest job ever let by the State Highway Department.

They have had mountain contracts with heavy grading through solid rock—and have had such excellent results in the past with 4 Gas+Air BUCYRUS-ERIES in rock digging, that they've now

bought another Gas+Air (their 5th)

making a total of nine BUCYRUS-ERIES bought by Horn.

And they write: "The way these Gas+Air machines handle rock is almost unbelievable. We would not consider any other make of shovel, and highly recommend the Gas+Air for hard service."

BUCYRUS ERIE

The Gas Shovel that has no equal for Big Production

For the steady big output that means profits on work as competitive as highway grading, cellar and foundation excavation, etc., the Gas+Air BUCYRUS-ERIE is without a rival. The direct-connected engines for crowding and swinging, driven by air—always in gear for *instant* action—give the extra speed in each digging cycle that produces outputs no other gasoline shovel can approach.

And it stands right up to the faster pace it sets; the Gas+Air BUCYRUS-ERIE is built with a big extra margin of reliability for hard work.

Write us for some of the remarkable reports from owners, on Output and Upkeep—showing what you can expect.

BUCYRUS-ERIE COMPANY

Plants: South Milwaukee, Wis., Erie, Pa., Evansville, Ind.

General Sales Offices: South Milwaukee, Wis., and Erie, Pa.

BRANCH OFFICES:

Boston	Atlanta	Buffalo	St. Louis
New York	Birmingham	Detroit	Dallas
Philadelphia	Pittsburgh	Chicago	San Francisco

Representatives and Service throughout the U. S. A. and Canada

Offices and agencies in all principal countries throughout the world

A Closed Unit to Meet Specifications

ALL specifications for road surfacing material specify a maximum size. In the Cedar Rapids One Piece Outfit, only material conforming to these specifications can reach the loading bin. The stone from the crusher is returned by the elevator for re-screening.

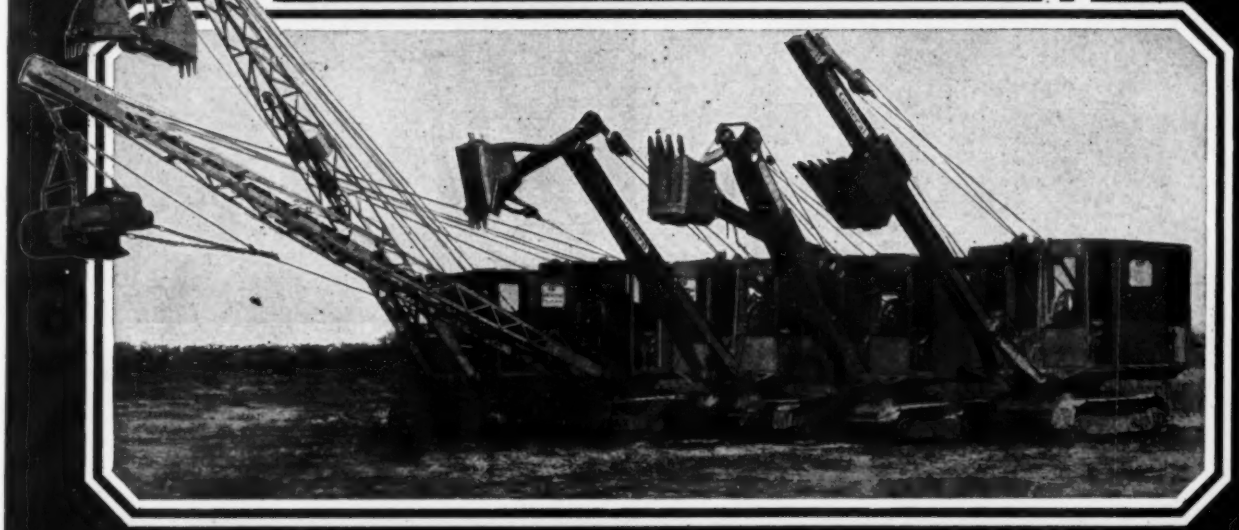
For further information —send for our catalog

IOWA MANUFACTURING CO.
CEDAR RAPIDS, IOWA

THE Cedar Rapids One Piece Outfit

Do you mention ROADS AND STREETS when writing? Please do.

The General's Staff



Each GENERAL EXCAVATOR is designed and built for efficient and dependable service as SHOVEL, CLAMSHELL, DRAGLINE, BACKHOE, SKIMMER, CRANE or BACKFILLER. It is full revolving and built in one size only. Any GENERAL boom assembly may be quickly and easily changed in the field to any other GENERAL boom assembly.

THE GENERAL EXCAVATOR CO., MARION, OHIO

DISTRIBUTORS IN ALL PRINCIPAL CENTERS—GENERALS EVERYWHERE

The GENERAL *will be* Exhibited *at the* Cleveland Road Show, Jan. 14 to 18 inc., 1929, *by the following* Distributors:

Alban Tractor Company,
821 E. 25th St., Baltimore, Md.

Bacon-Hibbard-Eichman, Inc.
917 Central Ave., Cleveland, Ohio

Edward R. Bacon Co.
Folsom at 17th St., San Francisco, Cal.

Balzer Machinery Co.
267½ Oak St., Portland, Oregon

Boehck Machinery Co.
2404 Clybourn St., Milwaukee, Wis.

Bublitz Machinery Co.
2139 Washington St., Kansas City, Mo.

Collins-Kay Machinery Co.
438 E. 3rd St., Los Angeles, Cal.

Contractors Machinery Co.
909 Summit St., Toledo, Ohio

Contractors Sales Co.
Room 408-75 State St., Albany, N. Y.

A. H. Cox & Company, Inc.,
1757 1st Ave. South, Seattle, Wash.

Arthur A. Davis,
32 N. Senate Ave., Indianapolis, Ind.

Edelen & Boyer Co.
236 N. 23rd St., Philadelphia, Pa.

Engels Tractor Co.
336 N. Genesse St., Utica, N. Y.

General Excavator Sales Co.
614 Rhodes Bldg., Atlanta, Ga.

General Excavator Sales Corp.
30 Church St., New York City

General Machinery Co.
3500 E. Riverside Ave., Spokane, Wash.

L. Z. Howell,
37 W. Van Buren St., Chicago, Ill.

Geo. E. Hoppe,
801 McDonough St., Richmond, Va.

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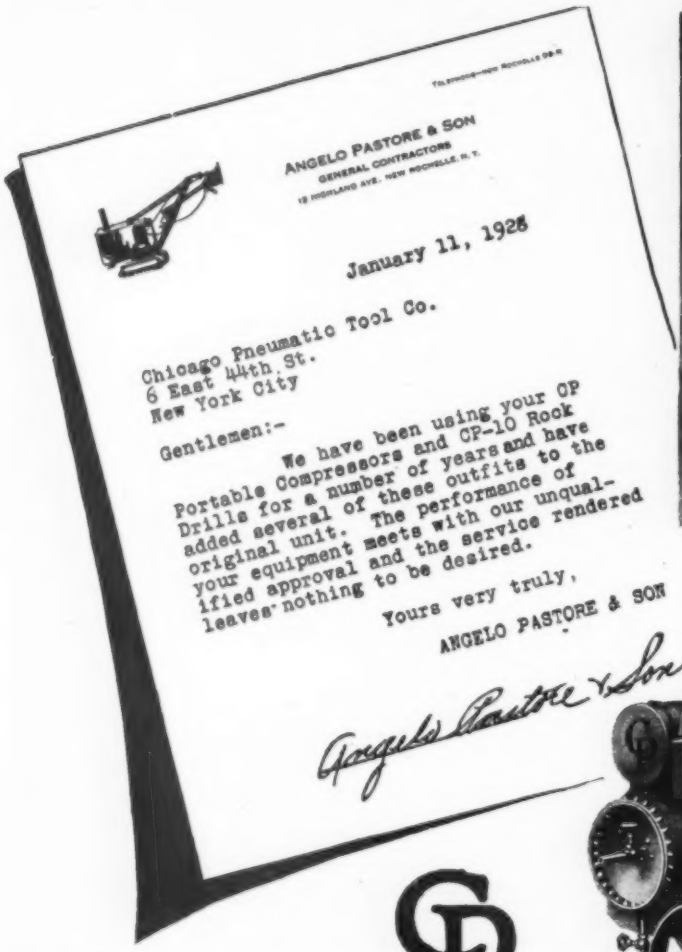

ANGELO PASTORE & SON
GENERAL CONTRACTORS
12 HIGHLAND AVE., NEW ROCHELLE, N. Y.

January 11, 1926

Chicago Pneumatic Tool Co.
6 East 44th St.
New York City

Gentlemen:-

We have been using your CP Portable Compressors and CP-10 Rock Drills for a number of years and have added several of these outfits to the original unit. The performance of your equipment meets with our unqualified approval and the service rendered leaves nothing to be desired.

Yours very truly,
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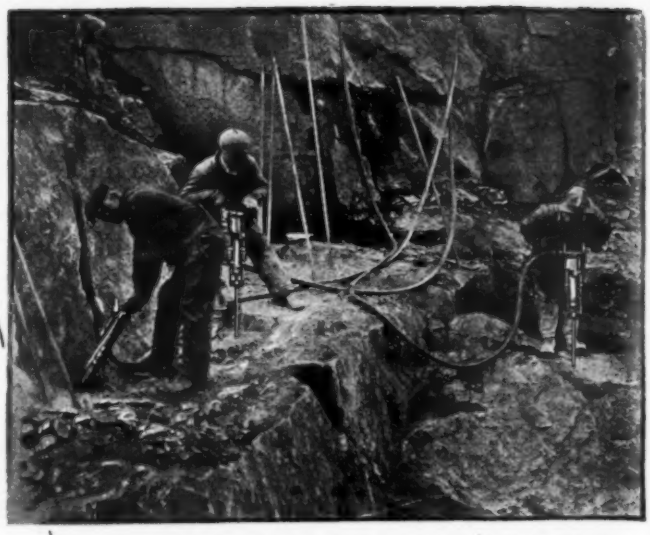
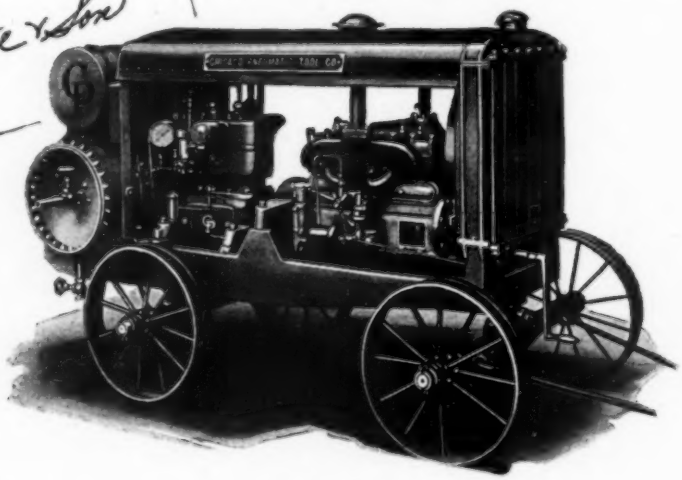


Widening 3 miles of Pelham Road, New Rochelle, N. Y. Approximately 60,000 yards of material to be removed, including granite, shale and soft, crumbling rock. The cut shown is 10 ft. wide up to 20 ft. deep and three CP-10 Rock Drills, powered by air from a CP Portable Compressor, are excavating an average of 700 yards daily.



CP-10

CP Rock Drills

Available in several sizes and weights to fully meet the requirements of contracting, mining and industrial work. Being fully cushioned the upkeep is low, and valve actuated, drilling speed is sustained despite wear. A force-feed lubricating system distributes oil to all working parts and insures long life.

The CP-10 is particularly suited to heavy sinking, extremely hard ground and long down-hole drilling. It weighs but 55 pounds, strikes a hard, rapid blow, is easy to operate and low in upkeep and air consumption. *Write for Bulletin No. 850.*

CP Portable Compressors Gasoline Engine Driven

Here is cheap, dependable power, available in many different sizes and several types of mountings. CP Portable Compressors are equipped with the famous Simplate Valves, Auto-Pneumatic Throttle, which slows down the engine when the compressor unloads. Quickly Detachable Flexible Coupling, directly connecting compressor and engine and many other important features explained in Bulletin No. 797. Write for it today.

CHICAGO CP PNEUMATIC

Chicago Pneumatic Tool Company

6 East 44th St., New York, N. Y.

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J-251

Yes—we would like you to mention ROADS AND STREETS.

Power and plenty of it! 82 HP

THE size clamshell used and the dipper capacity of a shovel-crane are not the biggest factors governing its daily output.

Back of these must be ample power for all operating conditions, and a dependable mechanism, free from excess friction, to transmit this power to the clamshell or dipper.

Plenty of power and a smooth running mechanism are part of the inherent design of every Industrial Brownhoist. The DC shovel-crane shown below, for example, is equipped with a big, slow-running engine of 82 H. P. and has, in addition, two speeds on both the hoist and travel.

Thousands of owners will tell you that you can't beat an Industrial Brownhoist for output, dependability and long life. Sizes range from ½ yard to 1¼ yards shovel dipper capacity and from 5 to 200 tons crane capacity. Each is a leader in its class.

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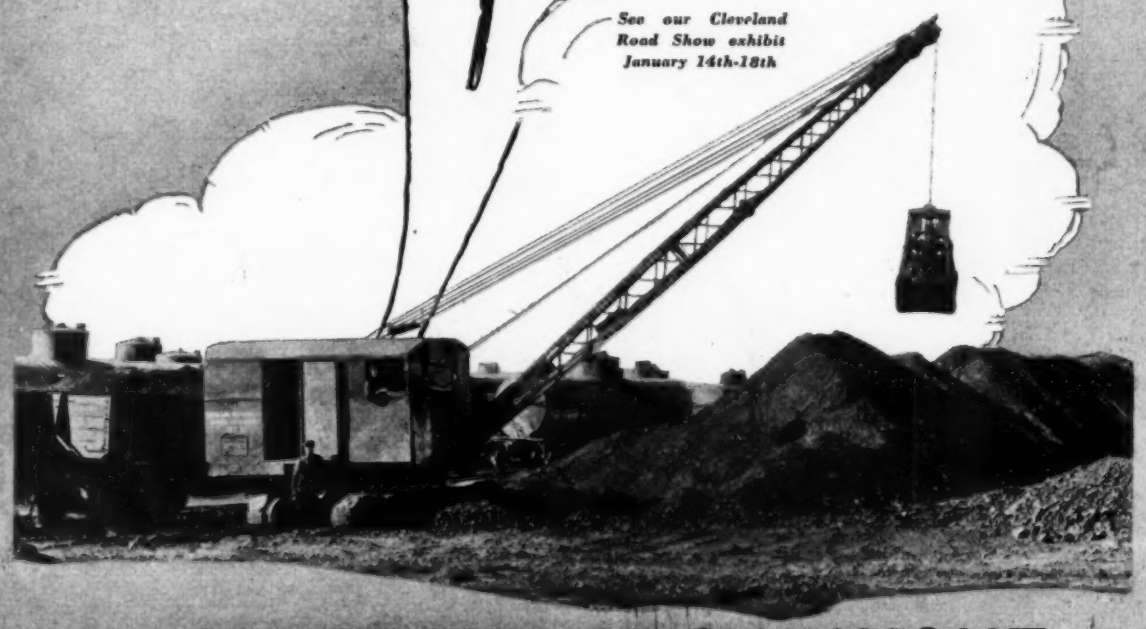
See our Cleveland Road Show exhibit January 14th-18th



INDUSTRIAL BROWNHOIST

SPEED UP TRAFFIC—*With Safety!*

LOOK at the picture below—not many vehicles in sight, are there? Yet this street carries thousands of vehicles daily. No congestion—just that steady, even movement at safe speeds, which makes the motor vehicle an efficient transportation unit when the streets and highways are adequately paved.

The street is Orient Way, in Rutherford, N. J. It serves a fine residential district, as well as the heavy through traffic from Newark, Paterson, Hackensack, and the Manhattan ferries.

Two factors make this street an efficient traffic carrier.

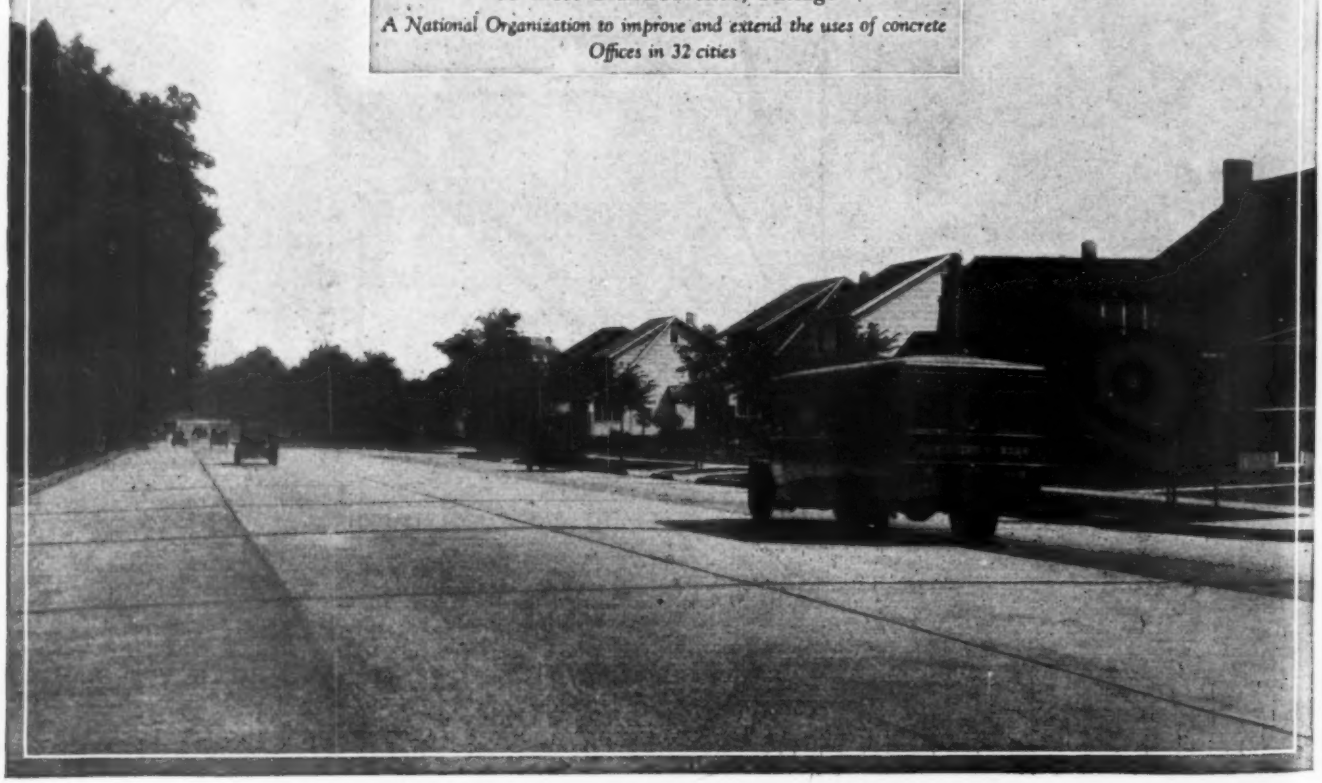
First, the pavement is portland cement concrete, *always* smooth and safe. Drivers know they can rely upon this surface—even if it is wet. At night, the clean gray concrete reflects the street lights evenly—no blind spots to puzzle motorists and hide pedestrians or vehicles.

Second, the pavement has ample width—sixty feet between curbs—to permit the traffic to spread out. There is no bunching of fast cars behind slow trucks. Every driver can maintain uniform speed at the legal rate, which means efficient progress—with complete safety.

This fine concrete street was paved under direction of H. E. Allen, City Engineer of Rutherford, by Contractors Bianchi and Smith, Lyndhurst, N. J.

What Rutherford *has* done, your city *can* do—build wide concrete streets to speed up traffic—*with safety.*

PORTLAND CEMENT ASSOCIATION
33 West Grand Avenue, Chicago
A National Organization to improve and extend the uses of concrete
Offices in 32 cities



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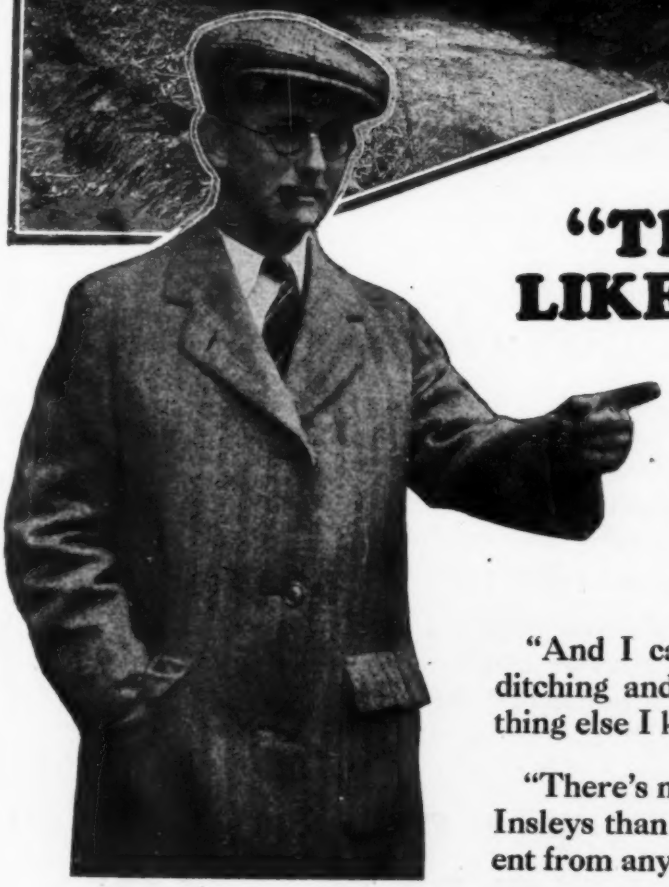

"THAT SOUNDS LIKE SENSE TO ME"

"I CAN buy an Insley for half what it would cost me to buy a big outfit, and I know I couldn't get a better piece of machinery if I paid three times as much as an Insley would cost me. I can get three or four hundred yards a day out of it and can do any kind of work there is to be done.

"And I can make more money on my grading, side ditching and unloading with my Insley than with anything else I know of and that's what counts these days.

"There's no use talking, I'm better off with one or two Insleys than I am with anything else, and I'm no different from any other fellow who wants to stay in business."

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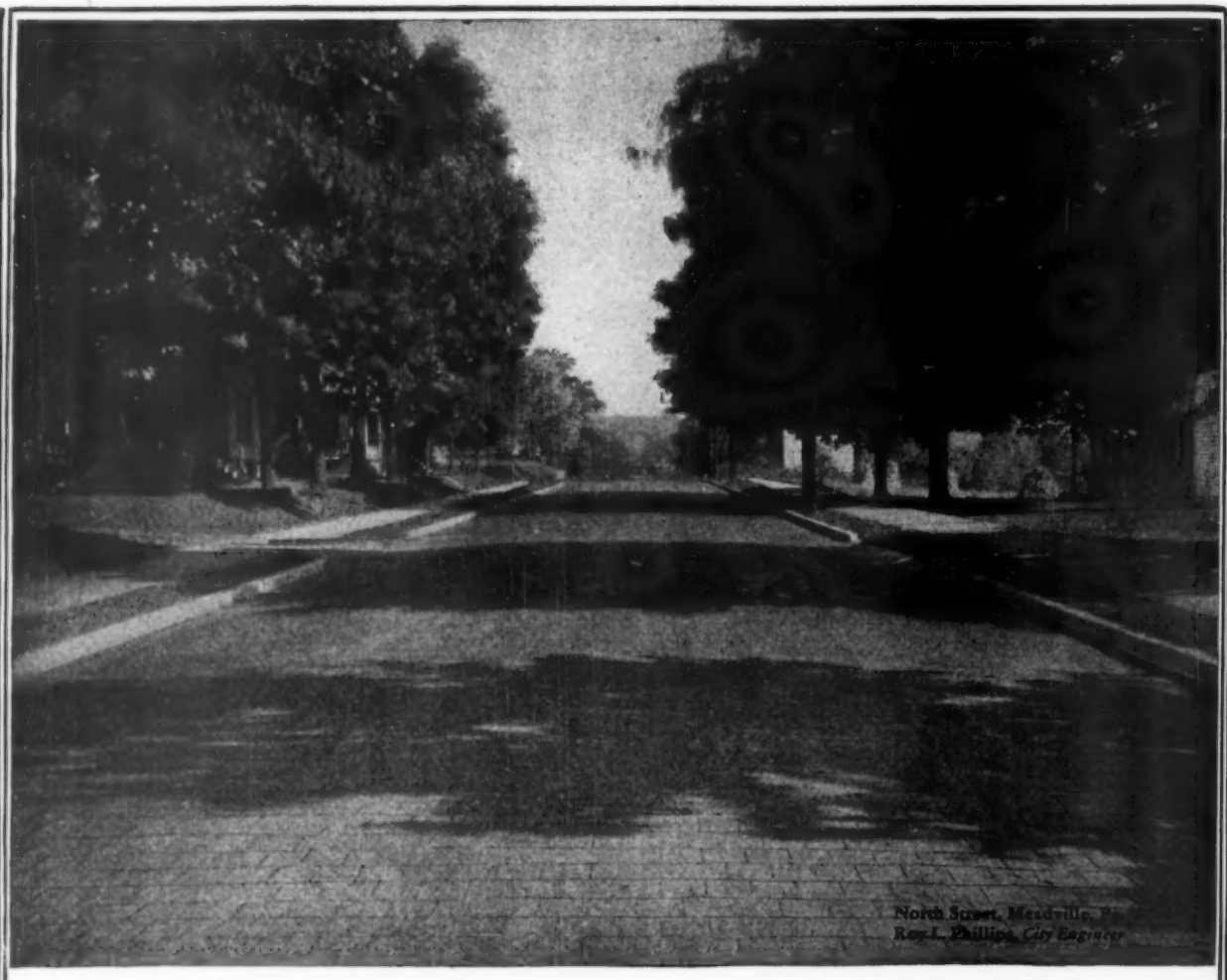
INSLEY MANUFACTURING COMPANY - Indianapolis

Engineers and Manufacturers



North Street, Meadville, Pa.
Roy L. Phillips, *City Engineer*

for this reason . . .
smaller communities *choose brick*

MANY smaller communities lay brick-surfaced pavements because they have no highway organization to take care of the large amount of repairs necessary in the less durable type of pavements. With brick, repairs are seldom necessary. The traffic is adequately served year after year at the lowest cost.

These are good reasons for the use of brick streets by all cities, whether large or small. For cost or engineering data, address National Paving Brick Manufacturers Association, National Press Building, Washington, D. C.

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BRICK PAVEMENTS
FACE THE FUTURE · PAVE WITH BRICK

Do you mention ROADS AND STREETS when writing? Please do.

CAMDEN

New Jersey is really as much a Keystone state as is Pennsylvania, in the sense that its contractors use many hundreds of Keystone Excavators.

You will find them on nearly all the street paving and ditching contracts from Jersey City to Camden.

Fabio Matarzzo, of Camden, is the contractor on the interesting Skimmer job depicted below. The bucket is 5/8-yard; but in formations like this many contractors use the 9/10-yard Skimmer.

The illustration below shows the ideal Keystone method of excavating to a fine grade. The Skimmer is taking off about 18 inches of old road surface and is leaving the grade finished so that little or no hand trimming will be necessary.

The trucks form in line at the left of the machine, pulling into position with a minimum loss of time. The half-swing feature of the Keystone makes "spotting" easy, and the operator can "shoot" each bucketful at exactly the proper instant by means of the electric trip.

The electric trip makes the Keystone *the* Skimmer-Pullscoop Power Shovel. It is flexible, adequate and low in cost.

DIGS MORE KEYSTONE FOR A DOLLAR

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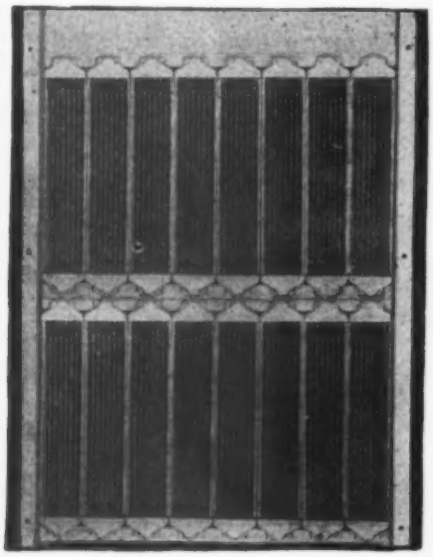
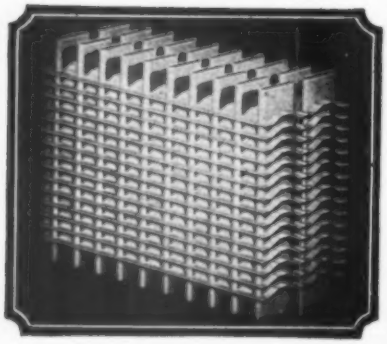
Turbotube Radiator



Modine Turbotube Radiator Cools the Monighan Walking Dragline Excavator.



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RADIATOR CORE

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CHECK the specifications of the better machines in your field .... whether they be automotive, farm, industrial, or oil engine .... and you'll find, "Radiator — by Modine."

Manufacturers recommend Modine Turbotube Radiators because of their greater cooling capacity .... their ruggedness .... their reliable performance under the most severe conditions.

And the recommendation of these manufacturers is confirmed by the ability of Modine to supply better radiators of any type, in any quantity.

Bring your cooling problems to us so you may better understand why, with better equipment, it always is, "Radiator — by Modine."

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Modine
Turbotube RADIATORS

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and that Standard is as high as a thorough knowledge of the needs of excavating and material handling, gained thru more than 50 years of actual experience, can develop.

On OSGOODS you will find every refinement or appliance that will improve the functioning of the machine or increase its output—things of vital importance to every owner and user.

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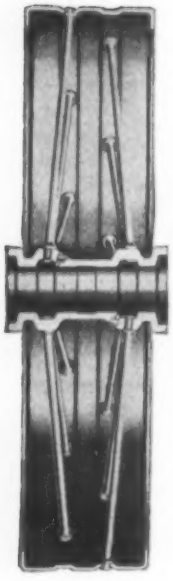
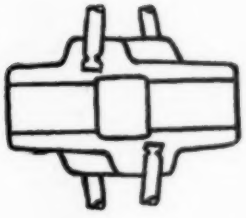
816

Structural Features of Steel Wheels

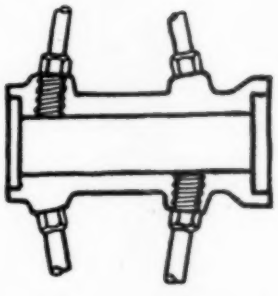


Each spoke is heated and forged in the hub, forming a head on the inside and a shoulder on the outside, similar to a boiler rivet.
It is expanded in the tire with a shoulder on the inside and the end is riveted on the outside.

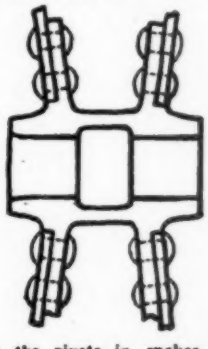
In all French & Hecht Wheels, the spokes are fastened in both the hub and tire by special processes that have been highly developed by French & Hecht. Compare this construction with other types.



Due to well known characteristics of cast iron it is impossible to secure uniform adhesion or tightness of spokes in this type of wheel. Sounding the spokes in a wheel will reveal the loose ones.



The locknut draws the spoke up so that the threads have a bearing on one side only. Spokes fastened in this manner tend to work loose in the hub. In this type of wheel the spokes are not fastened in the rim.



Here the rivets in spokes are under shearing strain. Also fastening of spokes to rim in this type of wheel offers certain difficulties that are not easily met.

ALL tests show that French & Hecht Steel Wheels are stronger than other types of wheels of equal weight. In addition, French & Hecht wheels have other structural advantages.

There are no limitations as to materials used. The hubs, for instance, in French & Hecht Wheels are designed to best meet the requirement of the machine on which they are used. The material may be cast iron, steel, malleable or steel tubing. Likewise spokes and tires may be of high or low carbon steel, etc.

The spokes may be flat, round or oval, and may be arranged in the wheel to best meet the load requirements.

Tire sections may be straight band, flanged, grooved, concave, convex, half oval, etc.—again depending on the mechanical and operating requirements of the machine. Notice how spokes are fastened in the tire in French & Hecht Wheels.

French & Hecht construction assures not only a stronger and more durable wheel, but a wheel so exact mechanically that it adds to the efficiency of the machine itself. French & Hecht, Inc., has devoted a vast amount of study and experimental work to all wheel problems and are the largest manufacturers in America specializing in the design and manufacture of steel wheels.

FRENCH & HECHT, Inc.

Wheel Builders Since 1888

DAVENPORT, IOWA **SPRINGFIELD, OHIO**

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STEEL WHEELS

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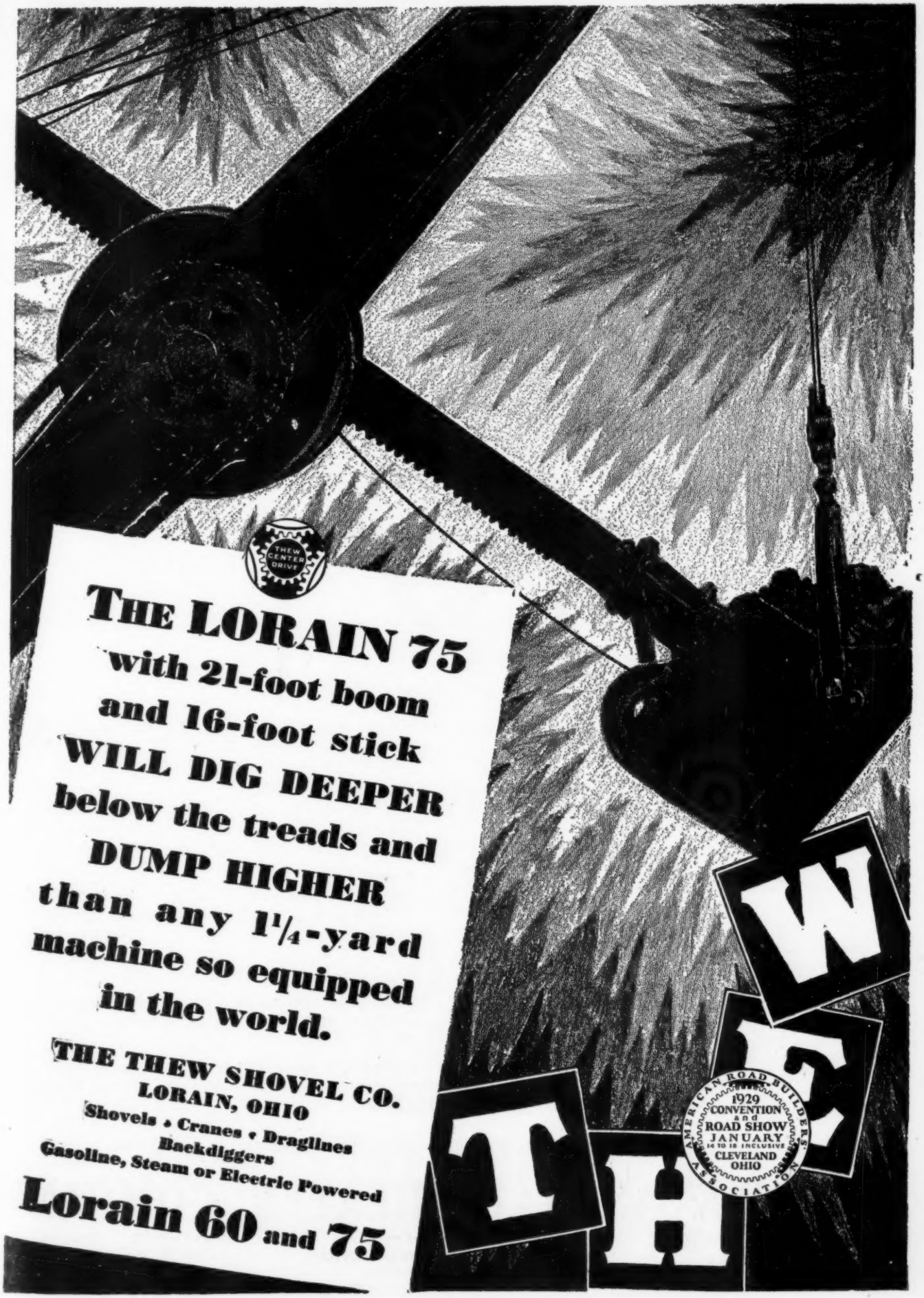
THEW CENTER DRIVE
THE LORAIN 75
with 21-foot boom
and 16-foot stick
WILL DIG DEEPER
below the treads and
DUMP HIGHER
than any 1¼-yard
machine so equipped
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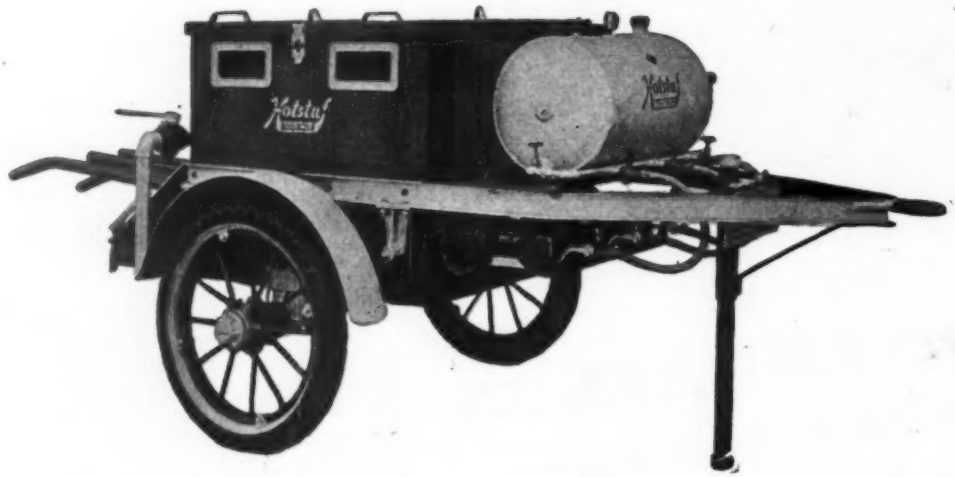
THE HEATER THAT SELLS ON ITS GREATER HEATING CAPACITY—RATHER THAN STORAGE CAPACITY

8 Exclusive Advantages Obtained by the PATENTED ELEVATED MELTING CHAMBER Built ONLY in MOHAWK HOTSTUF HEATERS



1. Cold material is melted in separate **Elevated Melting Chamber.**
2. **Greater Heat Absorption.**
   Intense heat is circulated directly under the **Elevated Chamber** and then indirectly down and under lower storage chamber.
3. **Oven Effect.**
   This indirect heat circulation produces an oven effect —holding the intense heat long enough to penetrate and utilize 30 to 50 per cent more heat units than is possible with the usual design.
4. **Distinct Hot and Cold Chambers.**
   The **Elevated Melting Chamber** is separated from the lower storage chamber by a solid removable partition plate with an opening at the bottom. Therefore it **distinctly separates the cold material** from the **Hotstuf** and makes it possible to **reload** with cold material **without cooling** the **Hotstuf.**
5. **Coking Practically Eliminated.**
   This patented construction eliminates coking by the natural flow of **Hotstuf** carrying the sediment to the storage chamber where it gradually carries off through the draw-off valve.
6. **Temperature Control.**
   This process of melting and the perfect temperature control eliminates all danger of over heating and of destroying the life of the material.
7. **Longer Life.**
   Due to the position of the Burner, the flame does not come in direct contact with the metal, thereby practically eliminating the danger of burning out the inner tank.
8. **Heat Insulation.**
   The entire bottom and walls of the firebox are insulated by separate lining plates forming a one-inch air space.

These **Eight** important points, plus many other modern improvements combine to make **Hotstuf** Equipment **The Master.**

Write our nearest office for full details—descriptive literature—prices, etc.

MOHAWK ASPHALT HEATER COMPANY

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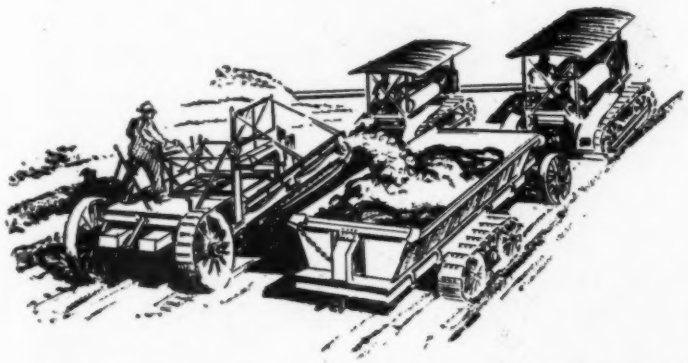

See at the Cleveland Road Show
Jan. 14th-18th

Leaning Wheel Graders
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IN these days of high labor and keen competition, new conditions are arising in the road machinery field. To an ever increasing degree, road construction and maintenance equipment must extend its performance to cover the greatest possible mileage for the money spent.

To Austin-Western these conditions are but the challenge that brings forth the best from leaders among men or organizations. Not for a moment has Austin-Western supremacy been threatened. By simply applying the engineering knowledge and manufacturing experience of 70 years, new improvements and new methods have brought *steadily lowering costs* in the road construction and earth handling field.

Contractors and others responsible for results will do well to check with us on their problems before ordering new equipment.

THE AUSTIN-WESTERN ROAD MACHINERY CO.
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ROAD MACHINERY

"MOST MILES FOR YOUR ROAD DOLLARS"

State Highway Dept. Maintenance Force laying Kyrock wearing surface on Yellowstone Trail, (U. S. Route 20) at Harbor Creek, Pa., Sept., 1928. Marginal curbs are not necessary with Kyrock. The inset shows views of unprotected Kyrock edge flush with concrete —after 5 years' service on the Latrobe-Kingston Road, Westmoreland Co., Pa.

A Kyrock Top Saves Concrete Roads

The Kyrock top protects the old base and prevents further disintegration. Surfacing with Kyrock may be done on half the road at a time without interruption to traffic. Kyrock is laid cold. It is resilient, non-reflecting, NON-SKID. On concrete it reduces vibration 75%. *Investigate Kyrock.*

The Yellowstone Trail—Cleveland-Buffalo road, (U. S. Route 20) constructed of cement concrete in 1920, was disintegrating under traffic. Patching was no longer effective and maintenance cost excessive. A wearing surface of Kyrock stopped the maintenance cost and restored this road to service, with a smooth, resilient, NON-SKID driving surface. No marginal curbs or extra shoulder material necessary—no interruption to traffic. *Investigate Kyrock.*

KENTUCKY ROCK ASPHALT CO., *Incorporated*, LOUISVILLE, KENTUCKY

Kyrock
The Uniform Pavement

KENTUCKY ROCK Kyrock ASPHALT

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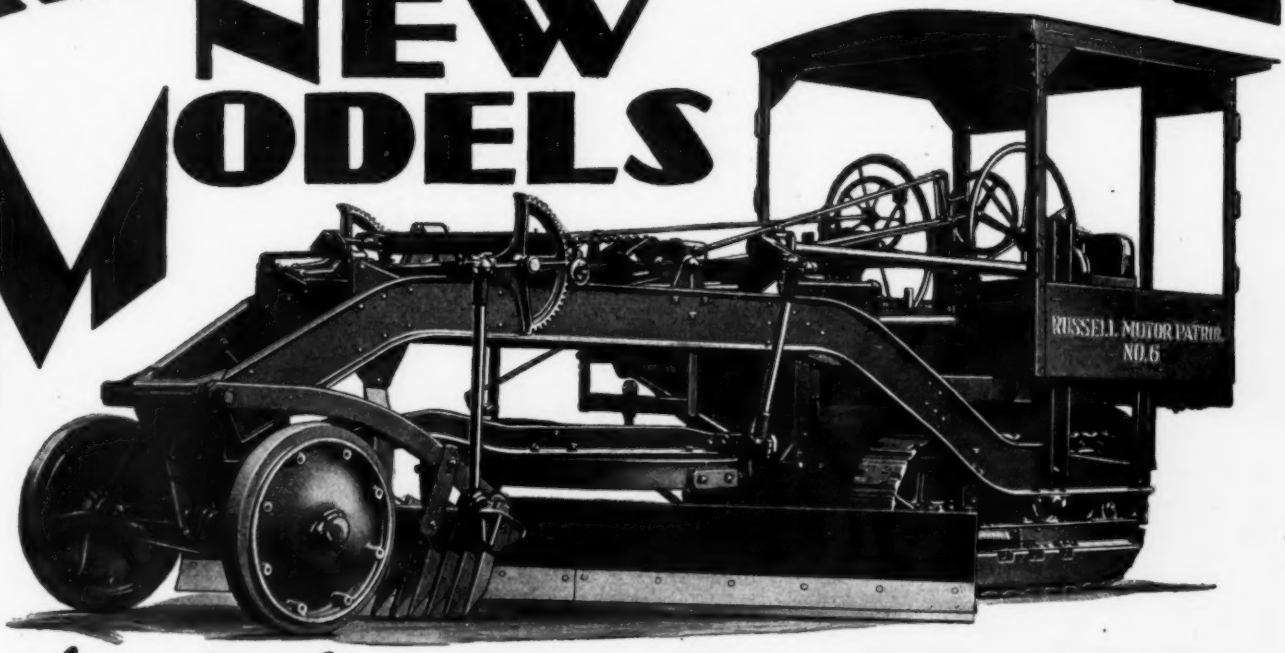


See The No. 6 MOTOR PATROL

Caterpillar 20 Tractor for Power with the RUSSELL Display at the 1929 ROAD SHOW

CONVENTION AND ROAD SHOW
1929
AMERICAN ROAD BUILDERS ASSOCIATION
JAN. 14 TO 18 INCLUSIVE
CLEVELAND, O.
SEE OUR EXHIBIT

Russell progress has always been along proven lines —improvements of unquestioned value—the building of better, stronger, more powerful road equipment.

Russell effort, energy and foresight have continually met the expectations and demands for greater capacity and more exacting efficiency in the tremendous job of road building and road maintenance.

Your opportunity to visualize the remarkable Russell progress is open to you at this National Exhibit—**Booth No. 46 in the West wing.**

JANUARY 14th to 18th CLEVELAND OHIO

RUSSELL GRADER MANUFACTURING COMPANY
MINNEAPOLIS, MINNESOTA

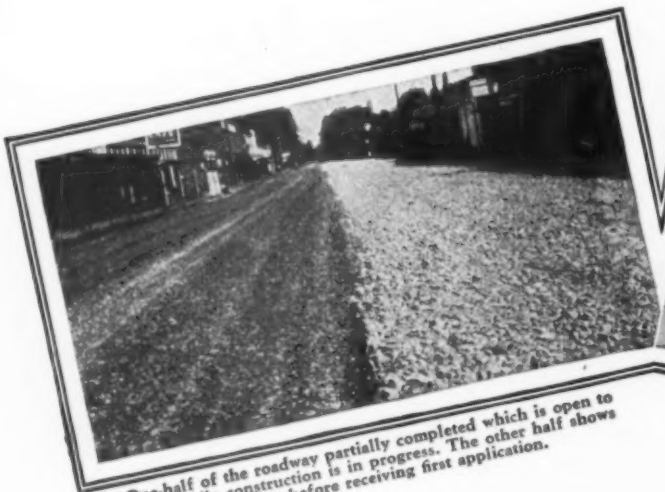
Stanolind Cut Back Asphalt

Resurfacing Roads by Retread Method

Missouri State Highway No. 16 Green County

Method used to apply cut back asphalt.

Road maintainer used to surface and mix on the road cut back asphalt and stone.



One-half of the roadway partially completed which is open to traffic while construction is in progress. The other half shows base stone before receiving first application.

Completed roadway five months later.

STANDARD OIL COMPANY (*Indiana*)

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Yes—we would like you to mention ROADS AND STREETS.

Plowing Through!

POWER to plow through heavy snowdrifts—speed to clear the lighter falls—thus Trackson McCormick-Deerings keep the highways open all winter. They are a sure guarantee for Open Roads.

Dependable under all weather and ground conditions, these Master Crawler-Tractors bring rugged, sure-footed power to any job. Real operating economy is assured by their faithful, efficient performance.

With the passing of the last snow fall, Tracksons are ready for road building, maintenance and construction work. For year 'round service, highway officials find them indispensable.

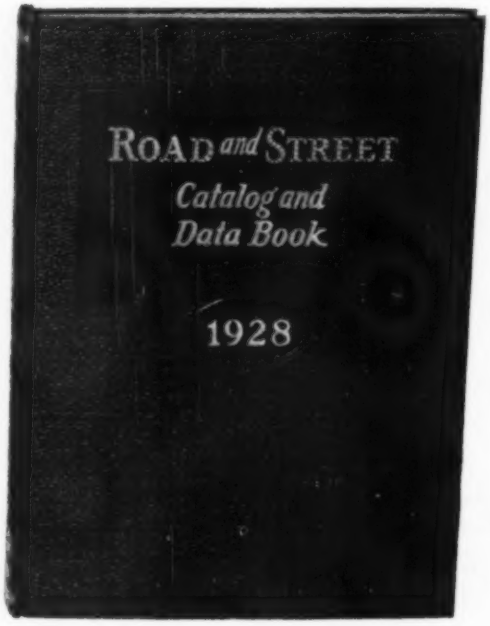
Learn how you may solve your snow problems. *Write now for full particulars.*

Trackson Company
FULL-CRAWLERS & TRACTOR EQUIPMENT
533 CLINTON ST. **MILWAUKEE, WIS.**

1929 ROAD *and* STREET
Catalog and Data Book

WILL BE OFF PRESS FEBRUARY 1st

Assures
Manufacturers
Catalog
Maintenance



Final Forms
Close
January
Fifteenth

ARE YOUR RESERVATIONS IN???

With a guaranteed distribution of 15,000 copies, every highway, road and street engineer, official and contractor who specifies and buys will receive a copy. You will want your products represented here every day in the year—

In addition to manufacturers' catalogs there is a Data Section equivalent to a 700-page handbook treating the subjects of design, construction and maintenance of highways, roads and streets. Our advertising department offers you free copy service.

A Folder Will Be Sent Upon Request.

Gillette Publishing Company
Established 1906

Executive and Editorial Offices: **221 East 20th Street, Chicago, Illinois**

SAN FRANCISCO CLEVELAND NEW YORK

Please mention ROADS AND STREETS—it helps.

BRITEMARK traffic markers more permanent than the pavement

More than 120 leading cities in the United States, Canada, and Europe are using the BRITEMARK *way of pavement marking.* BRITEMARK *Traffic Markers afford a safe, as well as permanent and economical way of indicating safety lines and traffic zones on all types of pavement; 3½ in. in diameter for heavy traffic and 2½ for light traffic.*

Capped with heavy, non-rusting, long wearing Monel Metal*—plainly visible in all kinds of weather, day or night.

Base and stem made of special heat treated, malleable iron defies pounding of heavy traffic.

Stem cast integral with base insuring permanence and strength.

Prongs spread when driven into pavement forming permanent anchorage in any pavement, granite block, brick, wood block, cement or asphalt.

Wood plug starts the prongs spreading.

METAL TRAFFIC MARKER CORP.

67 WALL STREET, NEW YORK, N. Y.

Distributors in all principal cities

*Monel Metal is a technically controlled Nickel-Copper alloy of high Nickel content. It has no coating to wear off. It is rust-proof, corrosion-resistant and as strong as steel.

Metal Traffic Marker Corp., 67 Wall St., New York
Please have your nearest distributor send me full information and quotations on your BRITEMARK Traffic Markers.

Name.....

Position.....

Address.....

City.....*State*.....

R&S 12-28

If *Results* Count, Here They Are!

One More Reason for Using *High-Early-Strength* Universal Concrete

Commercial Testing Laboratory Report

Note the *uniformly* high strengths obtained from test cylinders each of which was made from a different batch.

TELEPHONES ATLANTIC 0011-0012

WALTER H. FLOOD & CO.
CHEMICAL ENGINEERS
ROADS AND PAVEMENTS
938 EAST 44TH STREET
CHICAGO

October 6, 1928.

J. A. Ross Construction Co.
228 N. LaSalle Street
Chicago, Illinois.

Gentlemen:

No doubt you will be pleased to see the cylinder compression tests from the bridge-approach pavement you constructed at Bryn Mawr Avenue and the Sanitary Canal, Chicago. The results follow:

Date Placed: October 1
Date Broken: October 5

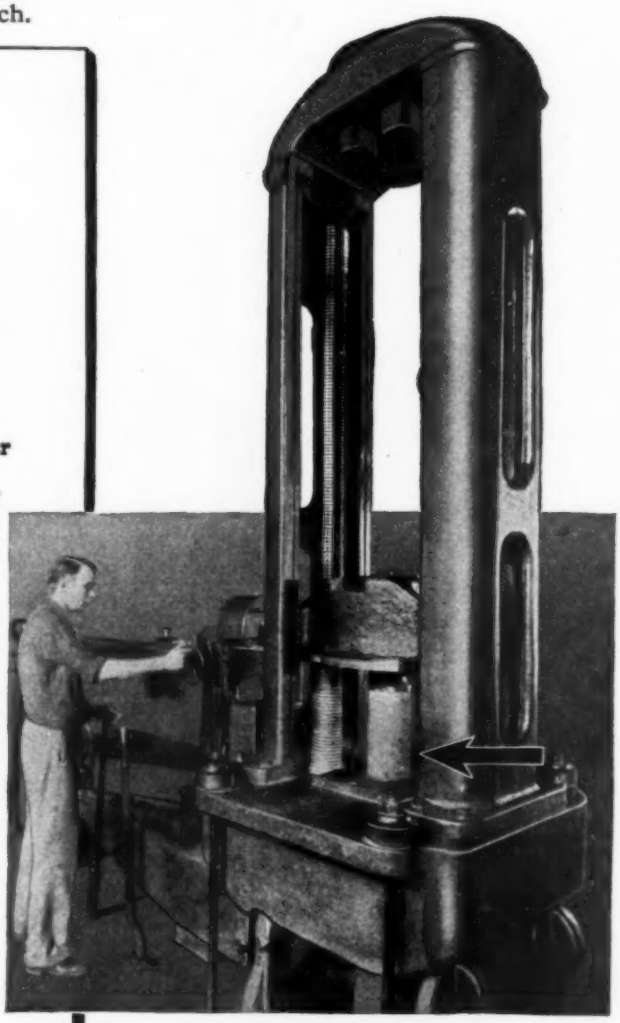
COMPRESSIVE STRENGTH. (Pounds per square inch)
Each cylinder made from a different batch.

Cylinder #1 - 2493
" #2 - 2581
" #3 - 2405
" #4 - 2390
" #5 - 2350
" #6 - 2390
" #7 - 2425
" #8 - 2440

These specimens show a well graded mixture and good compressive strength.

Respectfully submitted,

Walter H. Flood & Co.



Compressive Strength Testing Machine

Concrete as ordinarily mixed and placed reaches a compressive strength of about 2000 pounds per square inch in 28 days.

Tests on the above bridge approach show the *uniformly* high strengths that, with approved methods, can be obtained with the usual Universal cement in 1/7 the time ordinarily required.

These *high-early-strength* methods will be sent on request. Send the coupon.

Please send me new booklet.

Name

Address

Universal Portland Cement Co.
208 So. La Salle Street, Chicago

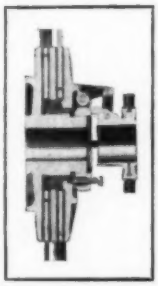
Without obligation, please send me new booklet giving full details for securing strong concrete in 3 days with the usual materials and labor.

R&S 12-28

Universal Portland Cement Co.
SUBSIDIARY U. S. STEEL CORPORATION
Chicago Pittsburgh Minneapolis Duluth Cleveland Columbus New York

One Standard Cement for All Concretes and Mortars

Yes—we would like you to mention ROADS AND STREETS.



Machines with a reputation for steady, efficient performance and long life will usually be found equipped with Twin Disc clutches.

Makes A Good Machine Better

THROUGH all the rapid progress of industry during the past few years, the Twin Disc Clutch has gained in favor as a factor in machine performance.

Twelve years of intensive specialization on clutches for heavy duty service of all kinds; complete facilities for designing and manufacturing clutches and power take-off units of any required capacity; the uniformly excellent service given by carefully engineered Twin Disc clutches, and the low prices made possible by volume production, are advantages you cannot afford to overlook.

Practically every clutch installation presents technical problems. Many of the most successful manufacturers have found it profitable, in more ways than one, to refer those problems to us for solution. Send your specifications, requirements or problems to our engineers. There is no obligation.

PARTS STATIONS

Boston (25), Mass.—Standard Auto Gear Co., 531 Columbia Road.

Buffalo, N. Y.—Edward W. Rode, 45 A. St.

Cleveland—Ohio Engine Parts and Service Co., 1053 E. 61st St.

Chicago—Motive Parts Co. of America, Inc., 2419 Indiana Ave.

Des Moines—Motive Parts Co. of America, Inc., 1204 W. Grand Ave.

Detroit—Whitney Brothers, 6464 Epworth Blvd.

Houston, Tex.—Portable Rig. Co., Inc.

Los Angeles—Coast Machinery Corporation, 406 E. Third St.

New York City—John Reiner & Company, Inc., 309 Church St.

Philadelphia, Pa.—Maerky Machine Works, 240 Cherry St.

Pittsburgh, Pa.—Motive Parts Co. of Pa., 6314 Penn. Ave.

Raleigh, N. C.—Motor & Equipment Co., 215 E. Davie St.

San Francisco—F. Somers Peterson Co., 57 California St.

Tampa, Fla., Motive Parts Co. of Florida, Inc., 708 Twiggs St.

Tulsa, Okla.—Buda Engine Service Co. of Tulsa, Inc.

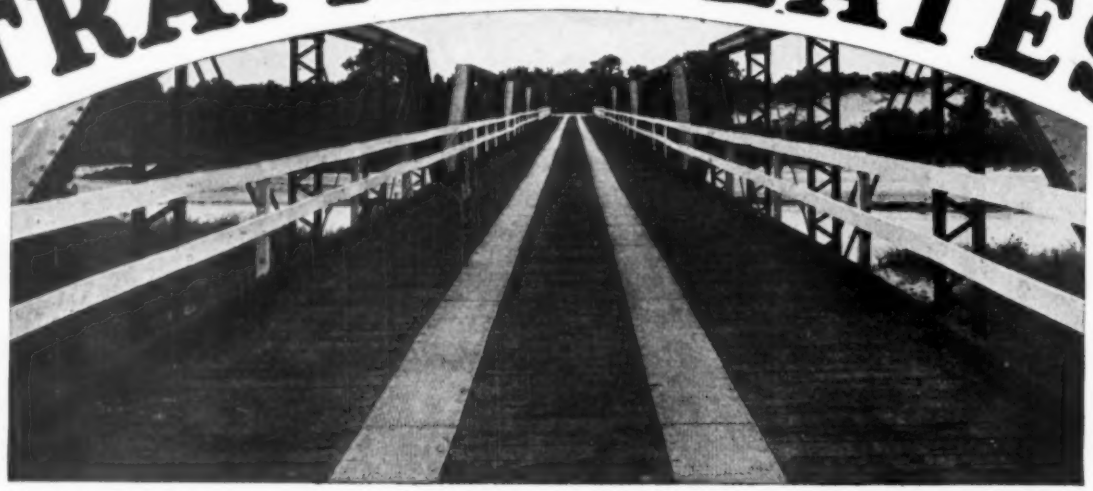
See Our Exhibit at the National Road Show

TWIN DISC CLUTCH COMPANY

RACINE WISCONSIN

TWIN DISC CLUTCHES

NEVERSLIP TRAFFIC PLATES



Neverslip Traffic Plates over new or old wooden bridge floors give a durable, non-slipping surface. They eliminate reflooring and strengthen the entire bridge.

Maintenance costs are reduced to a minimum or practically eliminated, as Neverslip Traffic Plates absorb the wear and make bridges stronger and safer, thereby extending its use to meet the present traffic demands.

Write for prices and descriptive circular.

AMERICAN PRESSED STEEL CO., Philadelphia, Penna.
AGENTS AND STOCKS IN PRINCIPAL CITIES

Guard Your Highways!

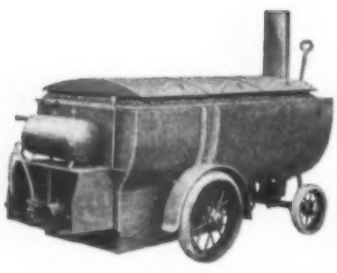
Style "A-1" the handy patrol heater will guard any highway with economy and efficiency. Something easy to handle and quick to heat. Equipped with standard roller bearings, grease cup insuring constant lubrications, Connery's Improved Springs and properly reinforced by Connery's Patented Ribs and angle iron. The fire box is equipped with renewable cast iron grate bars and is lined with heavy plate to protect furnace shell. Handle made of 3" channel iron equipped with large cast steel pulling ring. Rubber tires and heat guards optional equipment and furnished at additional cost. Heater can be equipped with Connery's Improved Oil Burner. Made in capacities of 65, 125, 150, 175 and 225 gallons.

Style "A-1"

CONNERY'S

HEAVY DUTY OIL BURNING HEATER

Style "B-2"



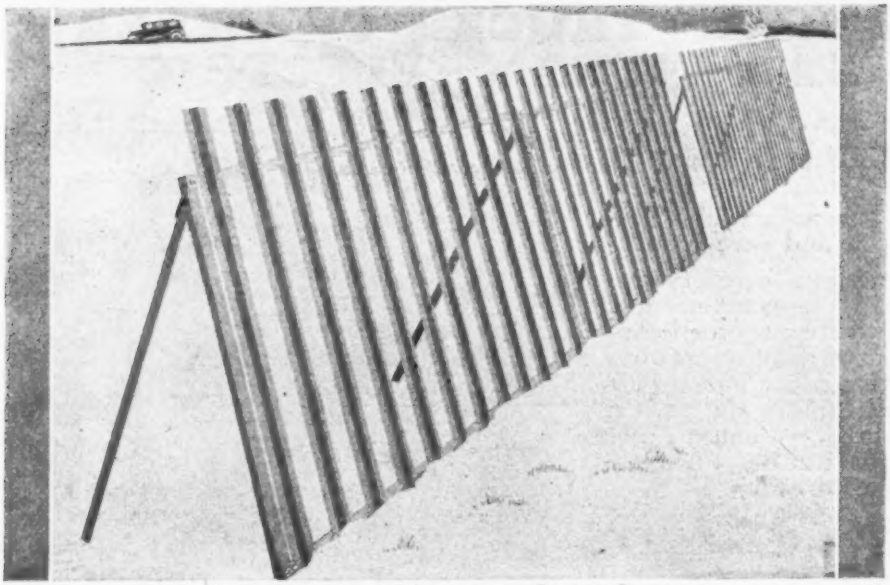
Was designed for road contractors and municipalities who require hot tar or asphalt in large quantities and need it in a hurry. This kettle is made in three capacities, 300, 400 and 550 gallons, and will melt a batch of tar or asphalt in considerable less time than coal or wood.

We manufacture a full line of Tar and Asphalt Kettles, Oil Burning Kettles, Pouring Pots, Torches, Hand Spraying Attachments, etc. Send for our "Blue Book" illustrating our complete line.

CONNERY & COMPANY, Inc.

3900 N. SECOND STREET **PHILADELPHIA, PA.**

Yes—we would like you to mention ROADS AND STREETS.



Characteristic vane action—it actually stops the snow.

For scientific, lasting Snow Control—
All-Metal Emergency Units

METALVANE Snow Units give you complete, scientific control of your snow drift problem. You need only a single line of it at any "drift spot" because the vane principle actually stops the snow. A thorough study of snow conditions has developed this principle that actually keeps roads clean by keeping drifts where they belong—between the snow barrier and the road. The vane shaped "pickets" of Metalvane Units deflect the snow and cut down wind velocity so that snow drops in the dead area about 2 feet behind the unit where it forms a harmless drift. No need to line both sides of drift spots with successive lines of ordinary fence. This same vane principle makes the Metalvane *self-cleaning*—makes the snow drop behind—there can be no drifting on the barrier to rob it of its effectiveness.

Note the controlled drift behind the barrier —open road in rear.

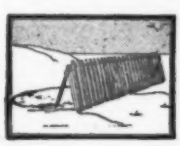
Place Metalvane at the worst drift spots of past years. And have a supply of it to use *during* the storm too, at unexpected drift points. Metalvane is the only satisfactory unit that can be placed during the storm, even after the ground is frozen.

All-Metal Emergency Units are portable, yet you can use them year after year. The "A" braces at both ends and the middle make them more substantial than most permanent barriers, and 18-inch frost pins hold in any soil. There is nothing but the best galvanized metal in the entire unit—nothing to rust, bend, rot or snap when you need it most.

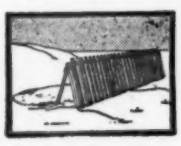
Metalvane All-Metal Emergency Units are easily erected, stored, and moved; handy units, light weight, no posts to drive, fewer feet needed because of greater efficiency—giving *economical* snow control.

To make sure of your supply of Metalvane, write today for our free bulletin: "Economical Snow Control."

THE METALVANE SNOW CONTROL CORPORATION, *Sioux Falls, S. D.*



METALVANE



U. S. and Canadian Patents: 264755, 264756, 267445 and 1545909

THE ALL-METAL EMERGENCY SNOW UNIT

LOCOMOTIVE – TRUCK – CRAWLER CRANES
GAS – STEAM – ELECTRIC

Let a Browning do it!

IF YOU have a handling job—let a Browning do it and save money!

There's a size and type for every conceivable kind of a job—giant steam or electric locomotive cranes for heavy duty work; steam or gasoline crawlers for medium duty service and speedy truck cranes for lighter duty when mobility is essential. Whatever *your* requirements, you can do it better—and faster with a Browning.

THE BROWNING CRANE COMPANY
16226 Waterloo Road
CLEVELAND, OHIO, U. S. A.
New York : Chicago : Pittsburgh : Birmingham
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A Browning Crawler Crane on a sewer excavation job for the T. E. Gaffney Construction Co. at Astoria, L. I.

See our exhibit at the Road Show, January 14 to 18

BROWNING

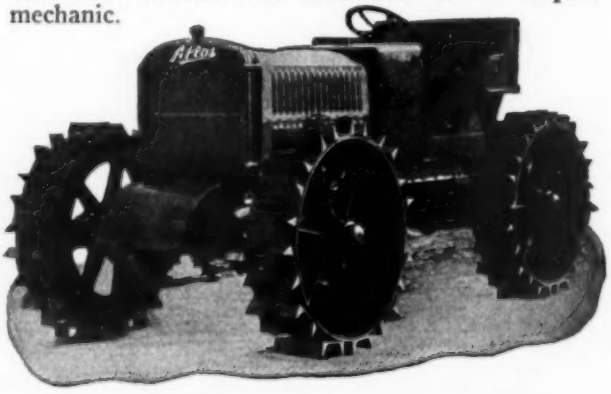
–ATLAS TRACTORS–
For Speed or Operating Economy

4 WHEEL DRIVE—4 WHEEL STEER

The name of Atlas 4 Wheel Drive and 4 Wheel Steer Tractor will stand for what is worth while in tractor efficiency. Infinite care will be observed at all times in giving to the users the best that engineering ability can produce.

With traction possibilities unequalled, with power that is ample and never-failing, and with traction and power vitalizing all four wheels, we have assured to the utmost the proper functioning of the three fundamental parts of a motor power vehicle—transmission, traction and motor. Add to this ease of handling, and a seat assuring driving comfort, and you make possible a day's work without fatigue to the driver. Add also the enclosure of all parts and you increase immeasurably the life of those parts, making certain greater economy and reducing trouble to a minimum.

Accessibility and easy serviceability depends upon the elimination of complicated design, therefore the Atlas design is such that it will give maximum efficiency for years at a minimum cost of up-keep expense. Breakdowns, although infrequent, are easily taken care of due to the simplicity of all wearing parts. Parts replacements can be made in very short time and without the assistance of an expert mechanic.

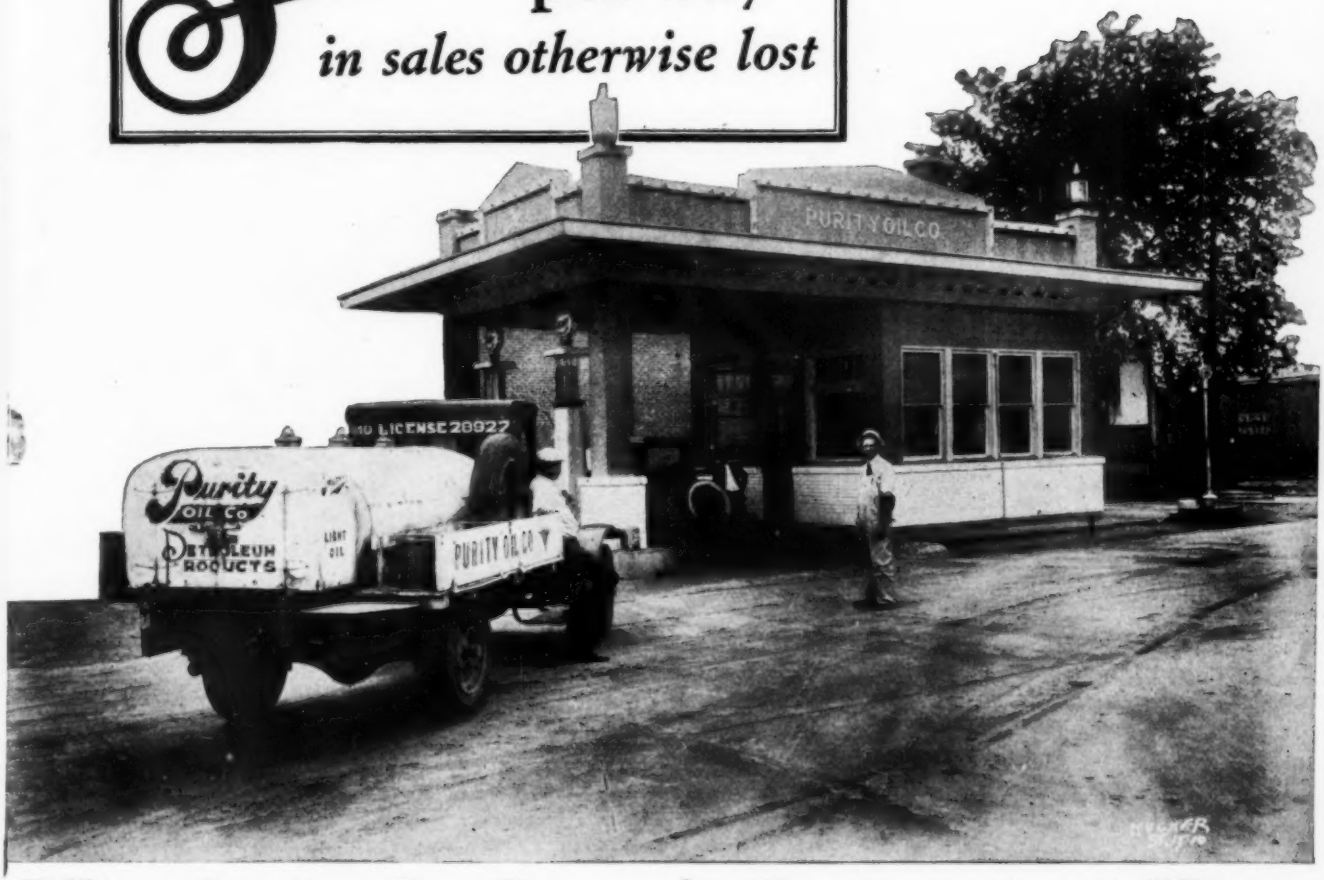


We will be glad to tell you more about Atlas Tractors. Send your name and address today.

ATLAS ENGINEERING COMPANY, Clintonville, Wisconsin, U. S. A.

Please mention ROADS AND STREETS—it helps.

Saved $125.00 per day *in sales otherwise lost*



Filling Station Re-Opens for Business in 24 Hours

WHEN Commercial St., Springfield, Mo., was closed for re-paving, this Purity Oil Station faced a daily loss in sales of $125 to $140. However, Mr. I. M. Long, Supt. for the Road District used Quikard Cement instead of ordinary cement and the station re-opened within 24 hours—saving 14 days or approximately $2,000 in revenue.

This instance is one among many demonstrating the actual time and money saving ability of Quikard, a true Portland Cement that meets all specifications and develops a 28-day strength in 24 hours.

Used in standard mixes, it produces a watertight concrete that requires curing only one day and may be placed in service within that time.

Do away with detours, blockades, watchmen, traffic hazards and curing over an extended period. Use Quikard Cement and open your concrete in 24 hours — making forms immediately available for other work and equipment and labor ready for the next job!

Produced Only by
ASH GROVE LIME & PORTLAND CEMENT CO.
Founded in 1882
329 Grand Avenue Temple, KANSAS CITY, MO.

Write

You owe it to yourself to learn more about the many economies of Quikard Cement. Packed in 5-ply paper bags, it is available in mixed cars with Ash Grove Portland Cement. Even if you are not now in the market, write today for additional data.

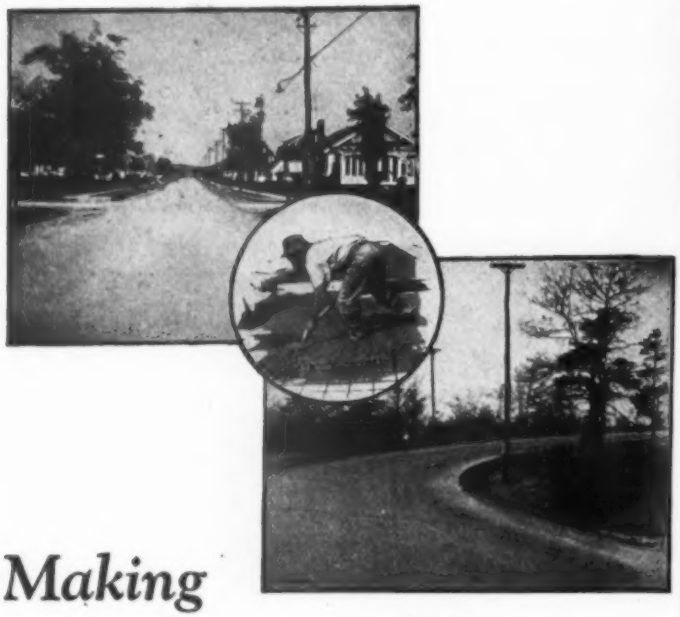
QUIKARD CEMENT (29)

A TRUE PORTLAND CEMENT

American Steel & Wire
Company's

WIRE FABRIC

"The Steel Backbone for Concrete"



Making City Street and Country Highway Permanent

TO reinforce concrete roads with Wire Fabric makes them permanent and is a proven economy. This fact is conclusively brought out in the report of the Highway Research Board, National Research Council.

Made of cold drawn high tensile strength steel, Wire Fabric has proved itself the perfect slab reinforcement. It gives the most effective distribution of steel—the closely spaced wires insuring greatest binding strength, holding the slab together as a solid unit and preventing the development of cracks.

Wire Fabric means permanent reinforcement—longer concrete life—lower maintenance costs. It is furnished in sheets cut to definite size which are easily handled and placed.

SALES OFFICES

CHICAGO.....208 So. La Salle Street
CLEVELAND.....Rockefeller Building
DETROIT.....Foot of First Street
CINCINNATI.....Union Trust Building
MINNEAPOLIS-ST. PAUL.....
.....Merchants Nat'l Bank Bldg., St. Paul
ST. LOUIS.....506 Olive Street
KANSAS CITY.....417 Grand Avenue
OKLAHOMA CITY.....
.....First Nat'l Bank Bldg.
BIRMINGHAM.....Brown-Marx Bldg.
MEMPHIS.....
.....Union and Planters Bank Bldg.
DALLAS.....Praetorian Building
DENVER.....First National Bank Bldg.
SALT LAKE CITY.....Walker Bank Bldg.
NEW YORK.....30 Church Street
BOSTON.....Statler Bldg.
PITTSBURGH.....Frick Bldg.
PHILADELPHIA.....Widener Bldg.
ATLANTA.....101 Marietta Street
WORCESTER.....94 Grove Street
BALTIMORE.....32 So. Charles Street
BUFFALO.....670 Ellicott Street
WILKES-BARRE.....Miners Bank Bldg.
*SAN FRANCISCO.....Russ Bldg.
*LOS ANGELES.....2087 E. Slauson Ave.
*PORTLAND.....777 Nicolai St.
*SEATTLE.....4th Ave. So., & Conn. St.
*United States Steel Products Company

Win against winter *with Haywards*

AFTER a snowstorm, traffic tie-ups cripple the city that's slow to act. *Speed* in snow handling is the first consideration.

Speed is assured when Hayward Snow Buckets go into action, as they did on Fifth Avenue, New York, the day the photo shown above was taken. Tall, frozen piles soon dwindle away under the rapid fire attack of buckets that *dig in* instead of *sliding over* icy slopes.

Speed is but one advantage of Hayward handling over manual labor. The lowering of removal costs is sure to accompany a great increase in the capacity for work.

The Hayward Snow Bucket is a two-purpose bucket which can be converted into a Standard Clam Shell by replacing the snow handling shell. Let us send you a copy of pamphlet No. 624; it tells how a Hayward "Makes Short Work of Tall Snow Piles."

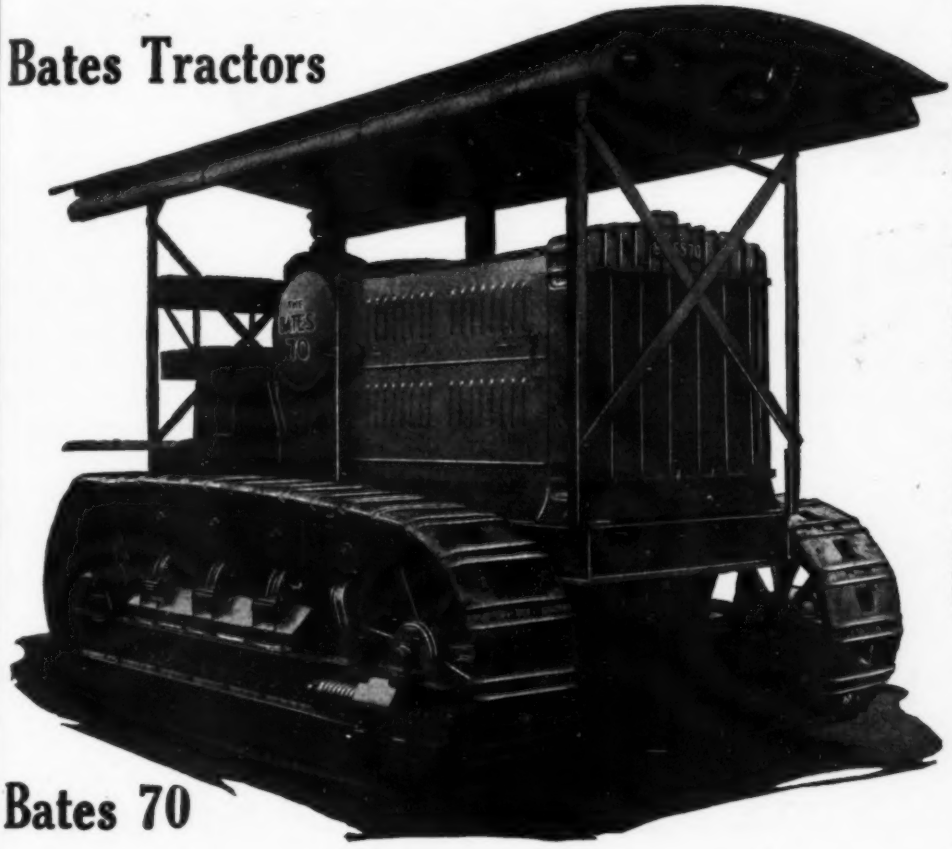
THE HAYWARD COMPANY
38-50 Church St., New York, N. Y.

Builders of Clam Shell, Orange Peel, Drag Line and Electric Motor Buckets; Dredging, Excavating, and Coal Handling Machinery; Automatic Take-up Reels; Counterweight Drums.

Hayward Buckets

Please mention ROADS AND STREETS—it helps.

Bates Tractors



Bates 70

3 SIZES

Bates 28 Made for 8 ft. graders and equipment of similar capacity.

Bates 40 Made for 7 yd. crawler wagons, 10 ft. graders, etc.

Bates 70 Made for 12 ft. graders and any of the largest tractor tools.

"I am well satisfied with the Bates Tractor. Before I bought the BATES "40" I saw one pulling the largest size Russell Grader and it handled it in good shape. I think the long crawlers are a *lot better.*"

An Illinois Contractor.

"We own a BATES "40" tractor, and have been running it ever since we got it in. Have not had one minute's trouble with it so far. We have 5 or 6 different make machines in our county and I consider this the best tractor that we have ever bought."

From a Tennessee Highway Commissioner.

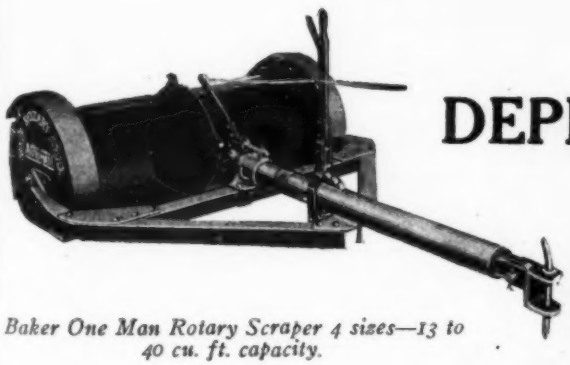
Write for New Catalog

Bates Manufacturing Co.
JOLIET, ILL., U. S. A.
Established 1883
Pioneers in the Tractor Industry

BAKER

DEPENDABLE EQUIPMENT

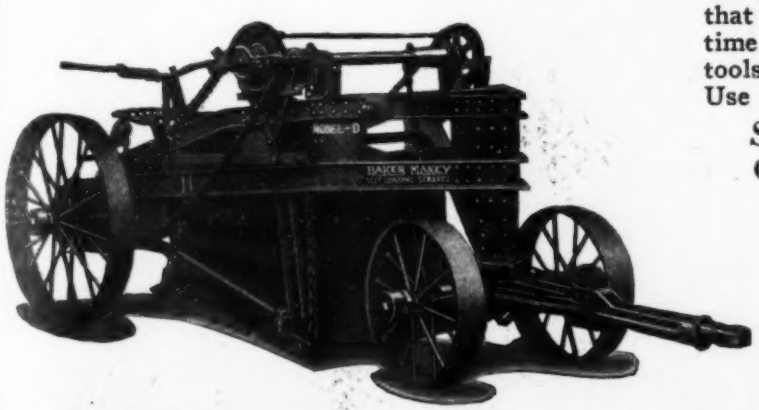
For Earth Moving
Snow Removal
Road Maintenance



Baker One Man Rotary Scraper 4 sizes—13 to 40 cu. ft. capacity.

Baker Products have a reputation for good performance and lasting qualities. If you want equipment for moving dirt, road maintaining or snow moving, select time-tried machines that have always made good. Save time and money by investing in better tools.

Use the coupon below.



Baker Maney Self Loading Scraper 3 sizes—¾, 1 and 1¼ cu. yd.

See Our Exhibit at Road Show
Cleveland, Ohio, Jan. 14th to 18th

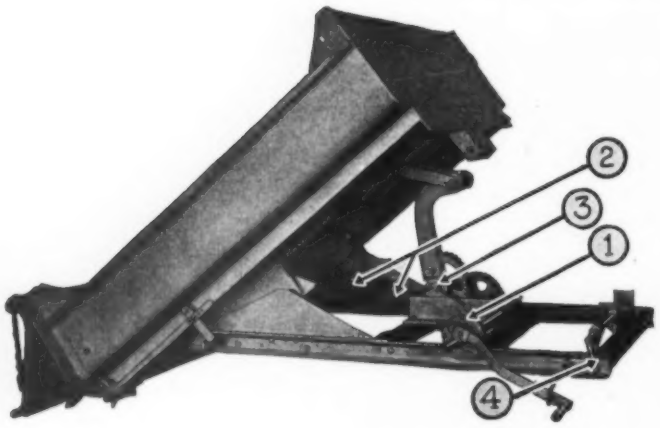
The Baker Manufacturing Co.
506 Stanford Ave., Springfield, Ill.

Send literature on ☐ Baker Maney Scraper
☐ Rotary Scrapers ☐ Road Maintainers
☐ Snow Plows

Name .....

Address .....

At Last, The Easiest, Quickest Acting Hand Hoist Dump Body For Every Vocation



(1) The new automatic roller lock positively holds the body in control at any angle, both in dumping the load and in returning the body to road position. This is a new appliance covered by our patents. It eliminates ratchets, dogs and brakes which apply directly to the crank shaft.

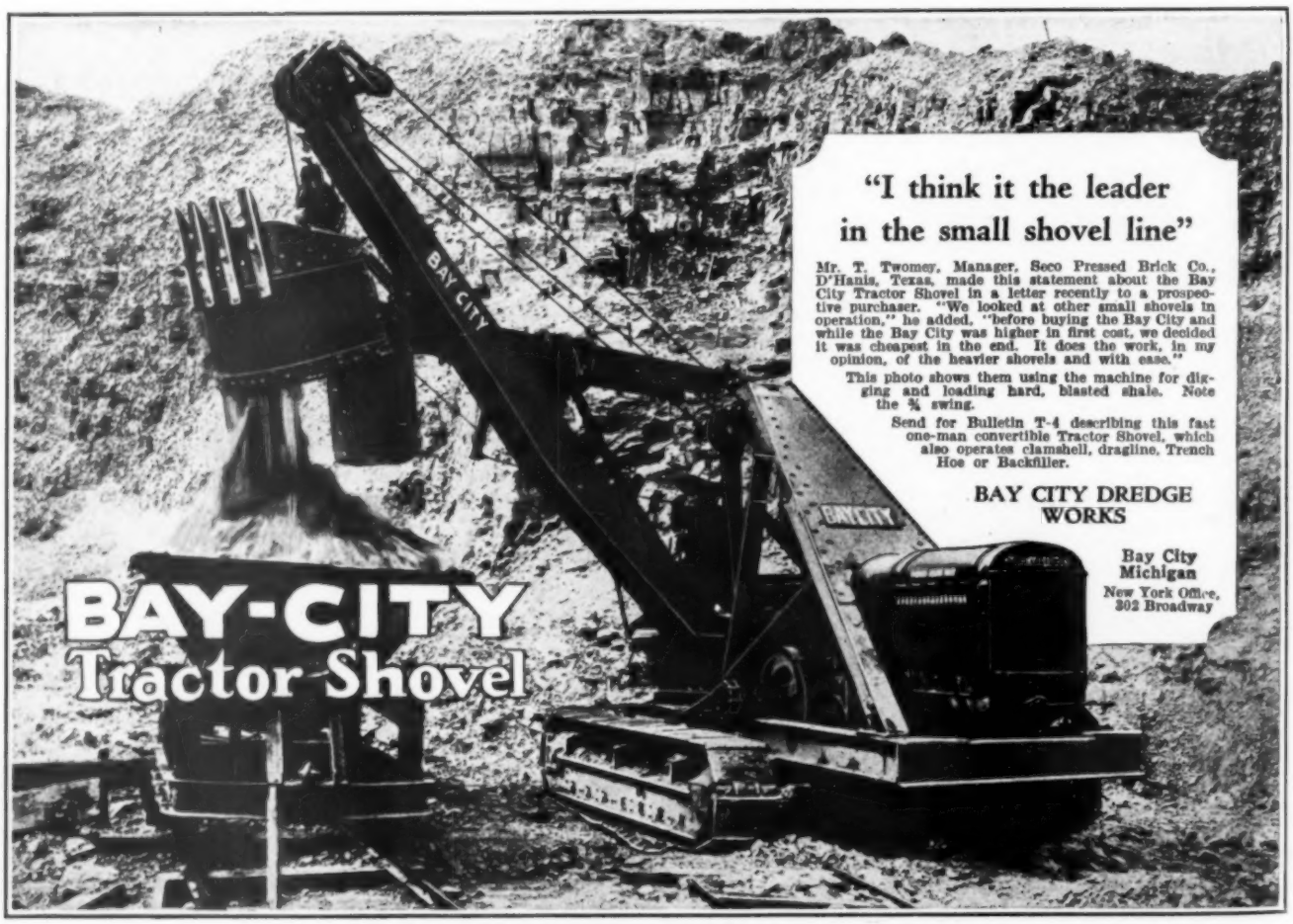
(2) The new roller and track mechanism permits the easiest and quickest dumping action possible.

(3) The simple, heavy, durable hoist is geared so that the load can be dumped in 4 turns of the crank handle.

(4) A positive locking device is provided, thus holding the body securely in road position. It also permits a 3-point suspension.

EVERY BODY IS GUARANTEED FOR ONE YEAR

The GALION ALLSTEEL BODY CO., Box 30 Galion, Ohio


BAY CITY
BAY-CITY
Tractor Shovel
"I think it the leader in the small shovel line"
Mr. T. Twomey, Manager, Seco Pressed Brick Co., D'Hanis, Texas, made this statement about the Bay City Tractor Shovel in a letter recently to a prospective purchaser. "We looked at other small shovels in operation," he added, "before buying the Bay City and while the Bay City was higher in first cost, we decided it was cheapest in the end. It does the work, in my opinion, of the heavier shovels and with ease."
This photo shows them using the machine for digging and loading hard, blasted shale. Note the ¾ swing.
Send for Bulletin T-4 describing this fast one-man convertible Tractor Shovel, which also operates clamshell, dragline, Trench Hoe or Backfiller.
BAY CITY DREDGE WORKS
Bay City Michigan
New York Office, 302 Broadway

Do you mention ROADS AND STREETS when writing? Please do.

INVESTIGATE BUTLER BINS

WHEN you're ready to buy new bin equipment you can't afford to overlook the savings that Butler Equipment can make.

Butler Bins are fast to operate, easy to load and they have ample headroom for trucks and batch cars.

They're easy to transport from one job to another and quick to dismantle or set up.

There are no cast parts to break—there's no waiting for repairs from the factory in case of accidental damage. Just remove a few bolts and straighten the damaged part at any blacksmith shop.

Ask for our new catalog. It gives complete information on all types of Butler Bins and Measuring Hoppers.

There is a distributor in your immediate vicinity. Write for his name and address.

SEE THIS OUTFIT *at the* ROAD SHOW

Everybody headed for Cleveland with an eye for new equipment and latest improvements in road machinery.

Don't miss the new improved Littleford Hand Spraying Attachment combined with the No. 84-W Oil Burning Tar and Asphalt kettle. Where it is impossible to use a large pressure distributor, call in this little outfit; it is ideal for penetration patching and shoulder work.

The new Hand Spraying Attachment has longer bearings making it perfectly rigid and free from wear; gear ratio of pump has been changed to produce a stronger flow of melted tar or asphalt. Many highway engineers have used our Hand Spraying Attachment to very great advantage — With the new improvements made for 1929 we are confident of a more extensive use of the Hand Spraying Attachment. In fact, we have received a vote of confidence from Texas in the form of an order for 41 large Oil Burning Trail-O-Heaters, all to be equipped with Hand Spraying Attachments.

1929
CONVENTION &
ROAD SHOW
A.R.B.A.
JAN. 14-18
CLEVELAND, O

Be sure to visit us at the Road Show, Booth WW-48. If you can't be there, drop us a line —we'll send complete information on the Hand Spraying Attachment by return mail. If you have not a copy of our Road and Street Maintenance catalog, write for one.

LITTLEFORD BROS.
454 East Pearl St., Cincinnati, Ohio

LITTLEFORD
ROAD & STREET MAINTENANCE EQUIPMENT

LITTLEFORD KETTLES SINCE 1900

— A Tractor Scraper —

Giving Greater Yardage With Less Labor

Here is a machine for which many contractors and road commissioners have been looking. The Western Tumblebug Scraper, working in plowed ground, is a self-loading tool of one cubic yard capacity. It can be worked singly or in trains. Loading and dumping are accomplished with little effort. Bulletin 28-DRS gives complete details. Just drop us a line and we will see that you have complete information.

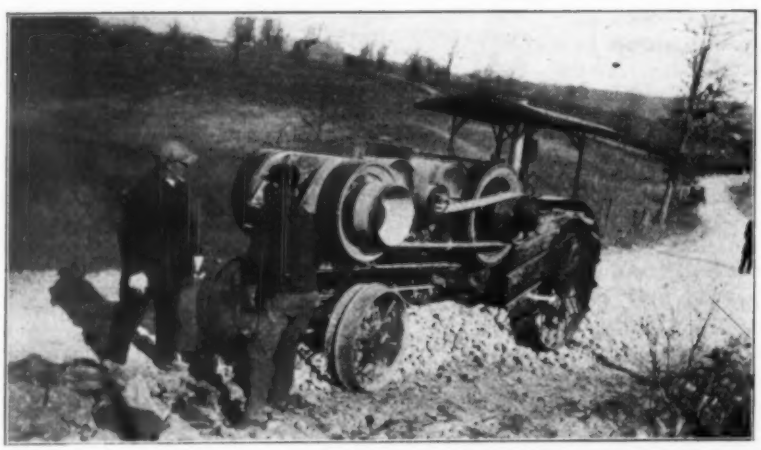
Western Wheeled Scraper Company
Aurora, Illinois

WHEELING No. 2 CRUSHER

Mounted on Eagle Tractor

Constructed to stand Heaviest Road Work

Does the work for less than one-half the cost of stationary crushers



By crushing stone along the road considerable handling of stone is saved, and by using the Wheeling Crusher mounted on an Eagle Tractor a saving of from 50 per cent to 75 per cent of the usual crushing and handling cost will be saved.

These portable crushers meet a long felt need of counties and contractors in repair work. Their capacity is good and the operating expense reasonable.

By all means investigate this Portable Crusher
Write for Bulletin

Wheeling Crushers Work at Very Low Cost

Machine may be moved forward without any delay in the crushing

WHEELING MOLD & FOUNDRY CO., Wheeling, W. Va.

INVESTIGATE

Westphalt

TRADE MARK

THE IMPROVED ASPHALT PAVEMENT

AT THE

ROAD SHOW

AN OLD FRIEND BY A NEW METHOD

WEST PROCESS PAVEMENT COMPANY, INC.

LOUISVILLE, KENTUCKY

K-M Grader Patrol

SAVES GAS
SAVES TIME
SAVES TIRES

QUICKLY DETACHABLE
QUICK TURNING
QUICK MANIPULATING

Patents Pending

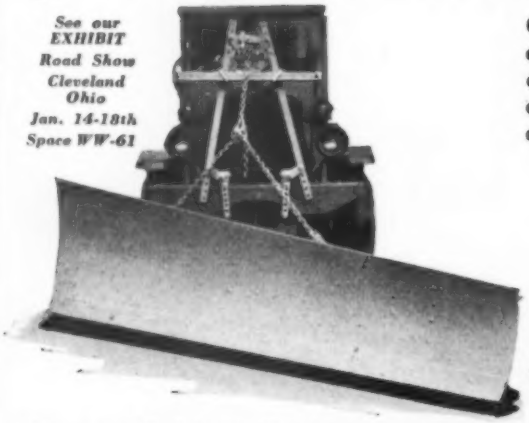
Progressive Distributors are Reserving 1929 Territory NOW. Write for Literature

LANDRETH MACHINERY COMPANY

Joplin, Missouri

Good Roads Snow Removal Equipment

See our EXHIBIT Road Show Cleveland Ohio Jan. 14-18th Space WW-61

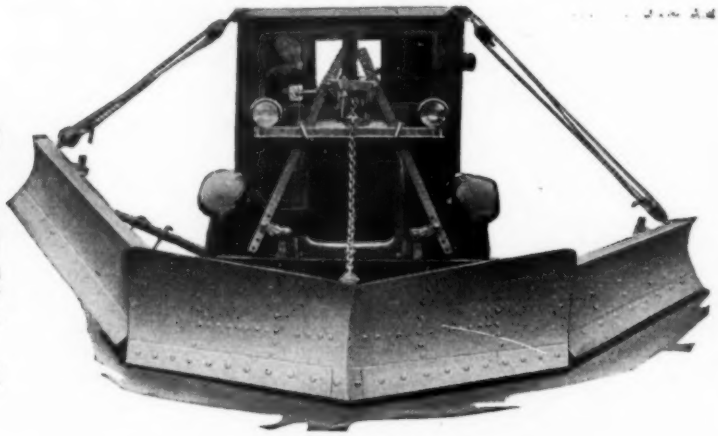


Above: Model 22 Good Roads Champion One-Way Non-Reversible Blade Plow for heavy duty with 3½ ton trucks and heavier. Tapered moldboard 37 in. to 22½ in.

At Right: Model 20-A V-Plow, with or without wings—a great general purpose plow for use on 2 to 5 ton trucks.

Fourteen other models. Catalog K. S. P.

Good Roads Champion Snow Plows for attaching to motor truck equipment of all kinds. Fourteen different models in various types enables us to fit you out with the plow that will best meet your conditions. Manufactured by the originators and pioneer builders of snow plow equipment for attaching to motor trucks.



The Good Roads Machinery Company, Inc.

"A business established and in continuous operation for fifty-one years—at Kennett Square in Pennsylvania"

Pittsburgh, Pa.....1523 Oliver Bldg.
New York, N. Y.....50 Church St.
Albany, N. Y.....36 State St.
Buffalo, N. Y. 733 Ellicott Square Bldg.
Philadelphia, Pa. 420 Commercial Trust Bldg.
Watertown, Mass.....36 Pleasant St.
Portland, Ore., 3d and Hawthorne Sts.
Chicago, Ill.....49th and Halsted Sts.

The Safest Spot on the Street

is made safe by

THE TOLEDO TORCH

It guards by day as well as by night, at a cost much less than for any other safety signal.

TOLEDO TORCHES will burn in a gale of wind, or a downpour of rain, or— a combination of both. They will burn twice as long as ever necessary without refilling. Recent developments make this the most dependable light on the market.

The Toledo Pressed Steel Co., Toledo, O.

When Snow Removal is a Problem

Your Galion Motor Grader does splendid work in road maintenance. It will also do splendid work in snow removal in moderate depths.

The blades alone will do good work but the snow plow or breaker is a very effective addition. Plan to use your motor grader for snow removal this winter.

Write for facts and prices

The Galion Iron Works & Mfg. Co.
Galion Ohio

Use Your GALION MOTOR GRADER The Year Round

1929 ROAD SHOW
January 14th to 18th, Inc.
Make our exhibit your Headquarters

GALION ROAD MACHINERY

WILL SERVE YOU BEST

Galion ROAD MACHINERY TRADE MARK

Have You Secured Your Copy of "Excavating in Pre-Drained Wet Soils"?

"Point" Under-Drainage
PICTURE HISTORY of the "POINT" Dewatering
EXCAVATING IN PRE-DRAINED WET SOILS
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This "Copyrighted," illustrated booklet contains much data of value to every Engineer and Contractor doing work in wet soils.

The edition is limited so you better fill out and mail coupon today.

FREE OFFER—Without expense or obligation to me—please send your copyrighted booklet "Excavating in Pre-Drained Wet Soils."

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R&S 12-28

DOMESTIC ENGINE & PUMP CO.
N. Queen St. and P. R. R.
SHIPPENSBURG, PENNA.

TWIN CITY ENGINES

Austin Model No. 600 Trench Machine equipped with 6 cyl. 7¾" x9" Twin City Engine

"BUILT TO DO the WORK"

MINNEAPOLIS STEEL AND MACHINERY CO. Minneapolis, Minn.

Heavy Duty Engine Manufacturers Since 1903

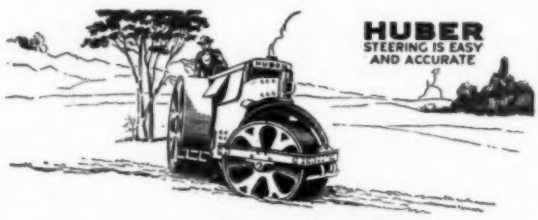
35 to 140 H.P.

The ever-increasing chain of TWIN CITY users include the following:

BROWNING-CRANES · AUSTIN-TRENCHERS · BALDWIN-LOCOMOTIVES · BUCKEYE-TRENCHERS · BUCYRUS SHOVELS AND CRANES · CEMENT GUN-CONTRACTING CO. · NORTH-WEST SHOVELS · PARSONS TRENCHERS · PENNSYLVANIA COMPRESSORS · SARGENT DRAGLINES · STAR-DRILLING MACHINE CO. · WASHINGTON LOGGING ENGINES · WILLAMETTE LOGGING ENGINES

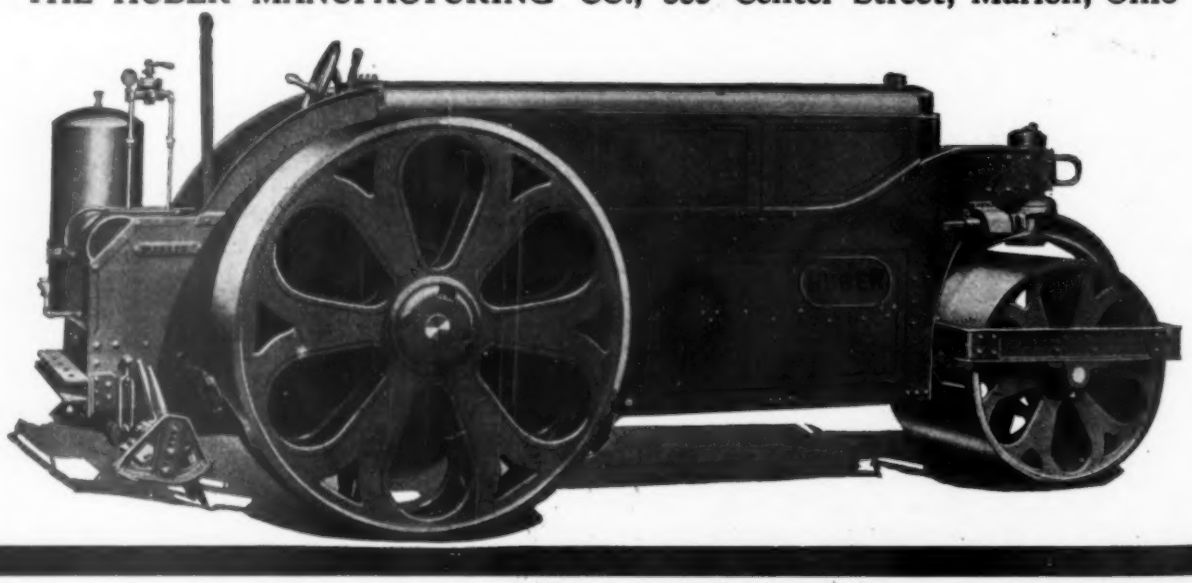
HUBER

4 Cylinder MOTOR ROLLER

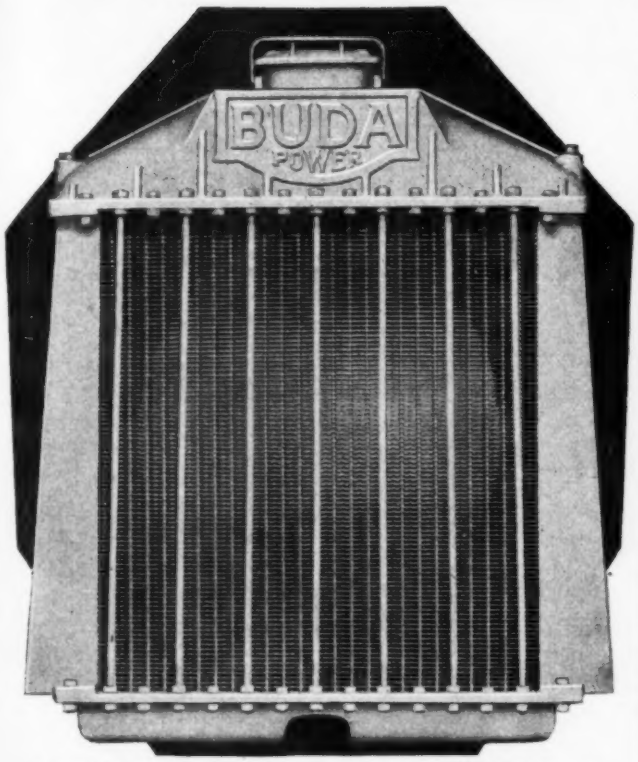


Proper distribution of weight, single lever control and wide range of road speeds make the Huber active and easy to handle. Write for catalog.

THE HUBER MANUFACTURING CO., 355 Center Street, Marion, Ohio



Do you mention ROADS AND STREETS when writing? Please do.



Young Radiators are standard equipment on all BUDA Power Units from the smallest BUDA gas engine to the large, powerful BUDA M.A.N. Diesel.

YOUNG Heavy Duty Radiators are the product of trained minds, there is no "labor" element. Every operation is performed by technically minded craftsmen under the supervision of a corps of efficient engineers who have the faculty of teaching—imparting knowledge.

The result is a working organization which tackles each job with understanding. Young Radiators prove in performance the soundness of the practice in their manufacture. The assumption that leading makers of heavy duty power machinery equip with Young Radiators is correct. They know that Young Radiators out-game the severest conditions.

Sturdy, heavy-duty radiators for trucks, tractors, power units, cranes, shovels, draglines, skimmers, backfillers, air compressors, hoists, winches, concrete mixers, pavers, pumps, drilling machines, etc., backed by a guarantee of satisfaction.

Young Radiators

YOUNG RADIATOR COMPANY

Racine *Wisconsin*

Pacific Coast Representative

S. CLYDE KYLE

Rialto Building San Francisco

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Young Quality

© Y. R. Co.

Young Radiators Are Used Where The Going Is Tough.

THE "AMERICAN-GOPHER" IS A BETTER SHOVEL-CRANE FOR LESS MONEY

It is ALL-STEEL.

Contains fewer wearing parts.

All Shafting is over-size.

SKF Ball Bearings wherever practicable.

All Gears nickel chrome or high carbon steel.

Interchangeable parts.

Machinery deck is a one-piece steel casting.

High pressure lubrication.

¾ and 1 yard capacity.

Lowest priced high grade machine of equal capacity.

AMERICAN

HOIST & DERRICK CO.

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PITTSBURGH, 604 Chamber of Com. Bldg.
ST. LOUIS, 1943 Ry. Exch. Bldg.
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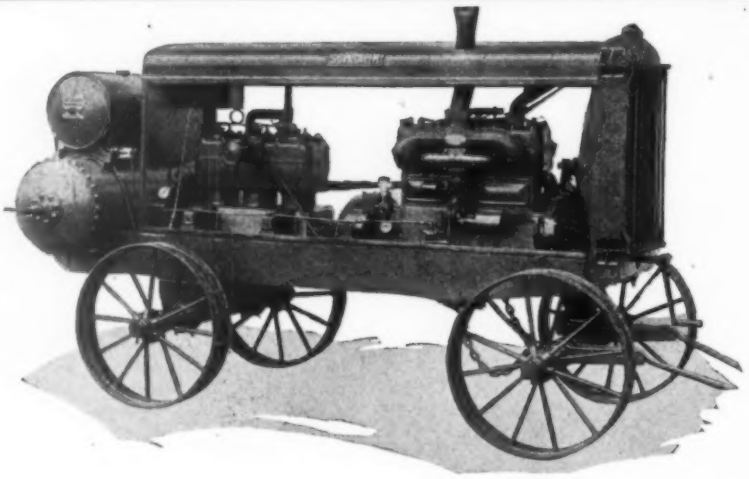
SEATTLE, Faneuil Hall Apts.
NEW YORK, 50 Church St.
NEW ORLEANS, 712 Union St.
SAN FRANCISCO, 139 Townsend St.
BIRMINGHAM, 1505 N. 34th St.
DETROIT, 13708 Fenkell Av.



60
120
180
240
360
Cu. Ft.

Write for new 1928-29 Catalog for complete specifications.

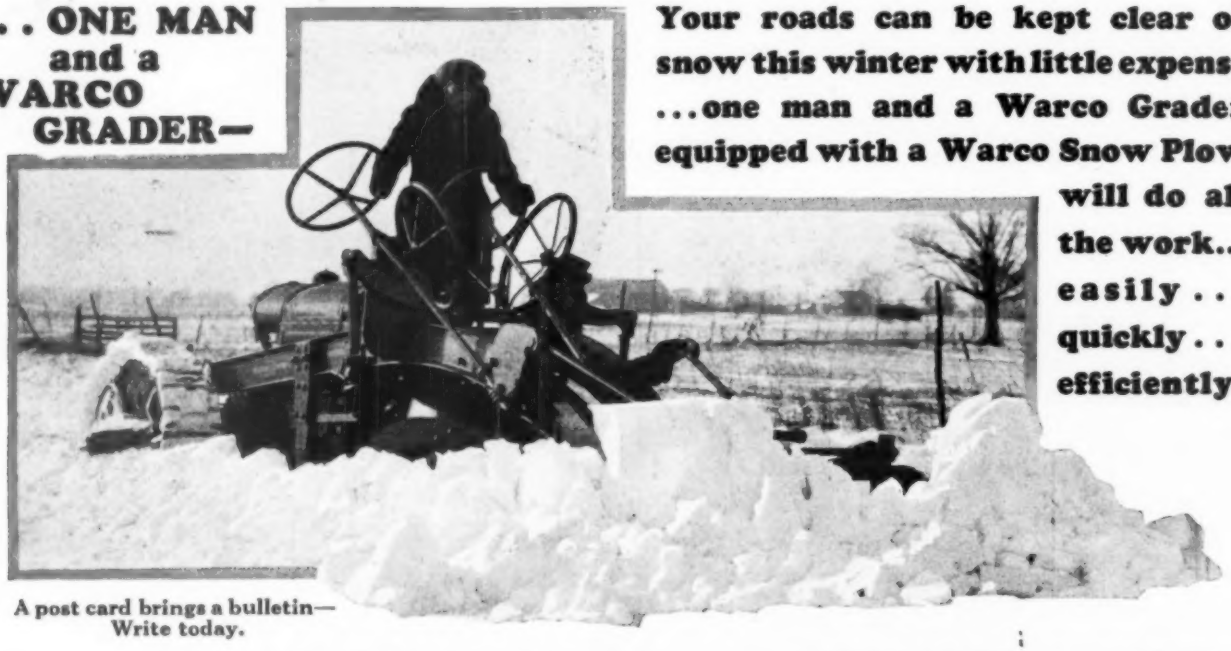
Greater horsepower
Larger capacity compressor
Clutch—easy starting
Slow down governor
Economical operation—THE SCHRAMM PORTABLE AIR COMPRESSOR
Furnished on steel or rubber tired wheels
Spring Trailer mounting, skidded, or fitted for mounting on Trucks, and Tractors.

Schramm Inc., Manufacturers

West Chester, Pa.

Offices and Representatives in Principal Cities

. . . ONE MAN and a WARCO GRADER—



Your roads can be kept clear of snow this winter with little expense . . . one man and a Warco Grader equipped with a Warco Snow Plow will do all the work . . . easily . . . quickly . . . efficiently.

A post card brings a bulletin—Write today.

W. A. RIDDELL COMPANY

DEPT. D

SEE OUR EXHIBIT
A. R. B. A. Convention and
ROAD SHOW
Cleveland, Ohio
Jan. 14–18 inclusive

BUCYRUS, OHIO

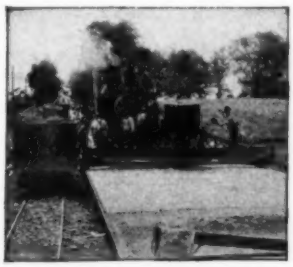
For Concrete Roads
Use "3-C" Calcium Chloride

Speeds Up the Job!

Makes Better, Stronger Concrete

A constantly increasing number of authorities on concrete construction are urging the use of Calcium Chloride as a *safe* accelerator.

In fact its use appears to be one of the most important developments in concrete road building. "3-C" Calcium Chloride, because of its high standard and uniform purity, has become a universal favorite.



"3-C" is always a profitable investment in concrete work. It shortens the time of curing, and greatly increases early strength. Its many advantages mean a worth-while saving in time and money.

The accelerating action of "3-C" Calcium Chloride is of special advantage in winter construction. It overcomes the tendency of cold weather to slow up the setting of concrete and it greatly shortens the hardening period through which protection from low temperatures must be provided.

Get complete information about this modern method. Write today for free copy of our booklet fully explaining the use of "3-C" Calcium Chloride in curing concrete.

3
COLUMBIA
CALCIUM
CHLORIDE

This Mark is Your Guarantee of Quality and Satisfaction

See Our Display at the Road Show

Columbia Chemical Div.
Pittsburgh Plate Glass Co.
BARBERTON, OHIO

ETNYRE "Model F" Distributors Continue to Maintain Their Remarkable Records for Maintenance Costs.

HERE is a record covering over five years of service showing the Repair Costs on ETNYRE "Model F" Distributors. These amounts were taken from copies of our 1927 invoices as of December 1 and includes many items furnished to replace loss by theft and breakage due to accident.

$ 3.46 per machine one year in service.
$20.45 per machine two years in service.
$36.40 per machine three years in service.
$48.70 per machine four years in service.
$34.65 per machine five years in service.

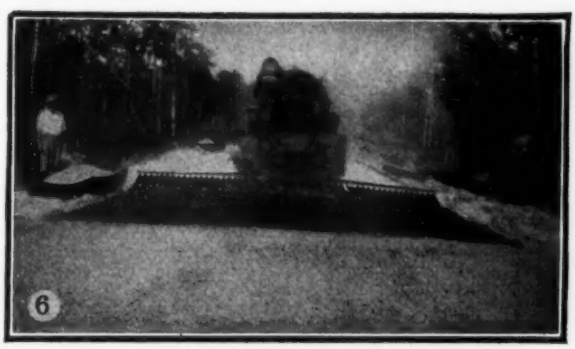
Every ETNYRE "Model F" Distributor we have turned out is still in active use. Up to December 1, 1927, there has not been a single flue or flue sheet replaced and we have not heard of a flue joint giving away.

1929
CONVENTION &
ROAD SHOW
A.R.B.A.
JAN. 14-18
CLEVELAND, O

Booth Number W.W.-6

If you are looking for the most efficient equipment ever designed for Heating and Distributing All Grades of Oil, Tar and Liquid Asphalt Used in Bituminous Road Construction and Maintenance, INVESTIGATE THE ETNYRE "MODEL F."

The ETNYRE CATALOG describes new features and tells why it will handle MORE GALLONS from the tank car to the road in LESS TIME and at LESS EXPENSE. Also why it does BETTER WORK by applying the material PROPERLY HEATED in just the RIGHT AMOUNT to produce the BEST ROADS.

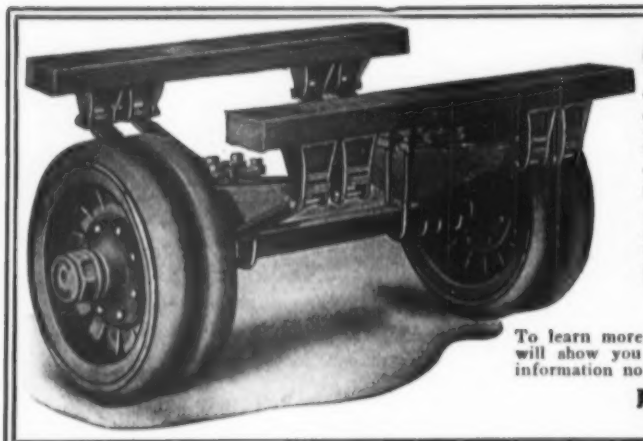


Second application, .7 gal. per sq. yd. Illustrations by courtesy of Dewey Hewitt and Standard Asphalt Co., Winter Park, Fla.

E. D. ETNYRE & COMPANY, Inc.
Flushers—Sprinklers—Oil, Tar and Asphalt Distributors.

61 Jefferson St. Etnyre OREGON ILL. **Oregon, Illinois**

Branch Offices in Principal Cities



Carry Twice the Load of a Truck

The Martin Semi-Trailer together with the Martin Rocking Fifth Wheel double and in many cases treble the carrying capacity of a motor truck without proportionately increasing the original cost of equipment or the running expense.

The Martin Rocking Fifth Wheel and Semi-Trailer can be kept busy from 85% to 95% of the time by using two or three Semi-Trailers.

While one is on the road others can be loading or unloading, thereby securing practically continuous operation of the motor unit.

To learn more about this equipment will cost you nothing and will show you how to reduce your hauling costs. Write for information now.

MARTIN TRAILER CO.
Westfield, Massachusetts

Mountings for Portable Equipment

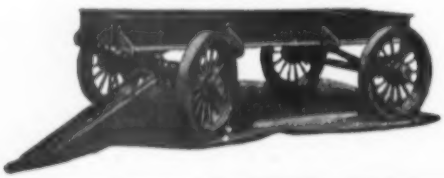
Rubber Tired Wheels
Steel Wheels
Trailers, Crawler Treads, Special Trucks, Axles

For all kinds of Portable Machinery, Contractors' Equipment, Engines, Hoists, Concrete Mixers, Compressors, Pumps, Crushers, etc.

Our engineering service includes a thorough study of the customer's requirements with suggestions as to the best type of mounting for each machine.

Ask for Bulletins, giving description of machine.

ELECTRIC WHEEL COMPANY
Dept. E. C., Quincy, Illinois



Put DOWFLAKE right in the Mixer

Dowflake, added right in the mix in the form of a solution, does away with the extra labor and expense of earth covering, and results in a faster-setting, more uniformly cured slab. It makes concrete more plastic, easier to spread and finish, and reduces the tendency toward surface cleavage, voids and pitting.

Dowflake has been proven practical—it saves time and money.

Dowflake is packed in handy waterproof 100-lb. bags.

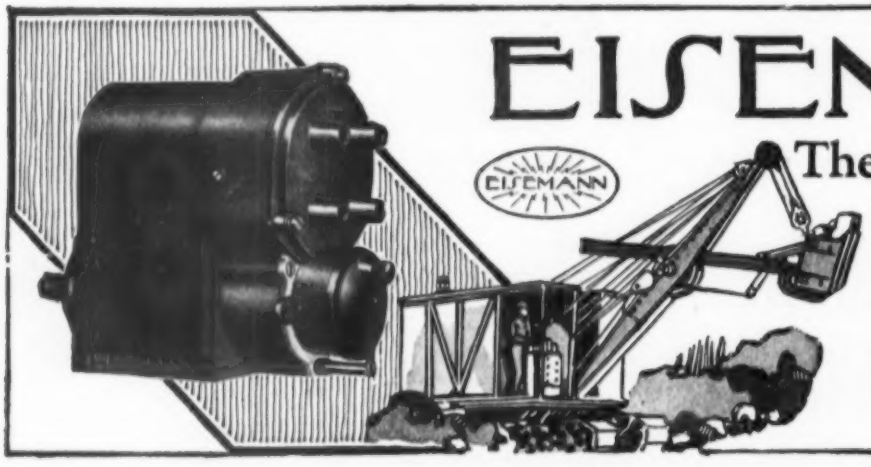
THE DOW CHEMICAL COMPANY
MIDLAND • • MICHIGAN

Branch Sales Offices:
90 West St. • New York City
Second and Madison Sts., Saint Louis

Send for *free* book "How to Cure Concrete."

See the Dow display at the Road Show Cleveland, January 14th to 18th

EISEMANN

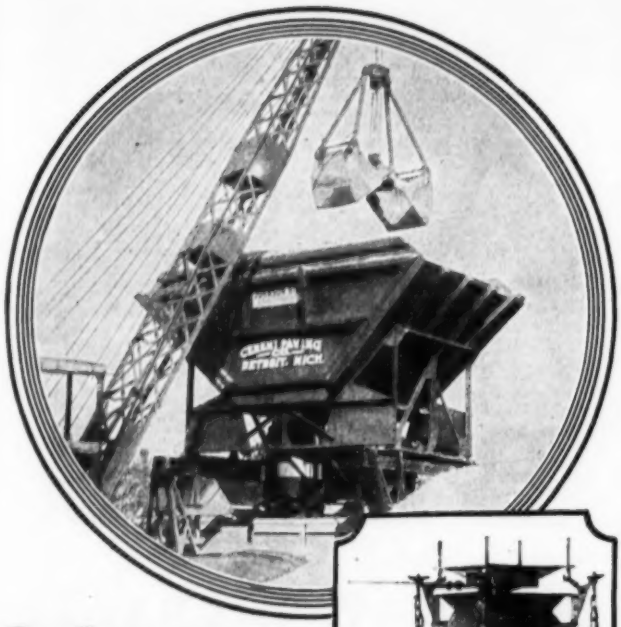


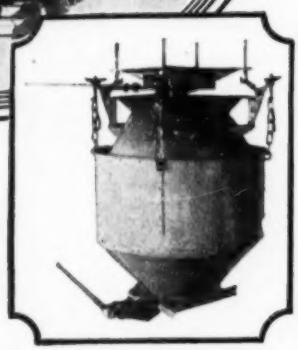
The Foremost Magneto

for Construction Equipment

The overwhelming choice of the builders of high quality equipment. Favored by contractors everywhere.

EISEMANN MAGNETO CORPORATION
165 Broadway - New York





Johnson Speed and Accuracy Mean Greater Profits!

Time saved on the job adds dollars to the profit column. Johnson Bins not only are speedy in operation but allow real time saving in erection or dismantling. Built in fully assembled steel units they are always ready for quick erection or dismantling when change of "set up" is required.

The speedy simple operation of Johnson Batchers is one of the outstanding reasons for their wide popularity. Their construction assures a full discharge, they measure accurately, and meet every requirement of State Highway Departments.

Johnson Scale Batchers simultaneously measure the material in each batch and indicate the weight of the volume as well—thus assuring a full yield of concrete, with no under-batching.

JOHNSON HYDROGRAVIC PROCESS

Write for complete information

C. S. JOHNSON COMPANY

CHAMPAIGN ILLINOIS

BINS AND BATCHERS

LEE MOTOR LIFT

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LEE MOTOR LIFT

MECHANICAL HOIST DUMP BODIES

(NOT HYDRAULIC)

YOU HEAR the name repeated whenever CONTRACTORS and MATERIAL HAULERS meet, they talk of its benefits and that there is nothing delicate, intricate or inaccessible in its construction—nothing to cause trouble to the driver or expense to the owner—not a detail that makes the LEE MECHANICAL MOTOR-LIFT HOIST anything but easy to keep in operation.

SUCH ACCEPTANCE by these most particular of DUMP BODY USERS is decidedly worth your investigation from a standpoint of ABSOLUTE RELIABILITY.

Write for full particulars of this Lee Motor Lift Body which can be mounted on any make of truck having P. T. O. opening in motor transmission gear case.

Gear Covering Removed to Show Hoist Gear Assembly

The Lee Motor Lift All Purpose Style Dump Body

LEE TRAILER & BODY CO.

Plymouth, Indiana

Manufacturers of Lee-Rolet, Lee 4-D and Heavy Duty Dump Bodies—Automatic Gravity—2 Speed Hand Hoist and Motor Lift Types.

Mobile Type Crushing Plants

Allis-Chalmers' mobile type crushing and screening plants consist of crusher mounted on steel truck, belt and bucket elevator with revolving screen mounted on steel compartment bin. They are readily movable by motor trucks and easily erected. Mobile type plants have been designed in sizes up to and including 10" Superior McCully Gyratory Crushers.

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.
Power, Electrical, and Industrial Machinery

The BERG is unequalled for removing surface irregularities — a requirement of state highway departments.

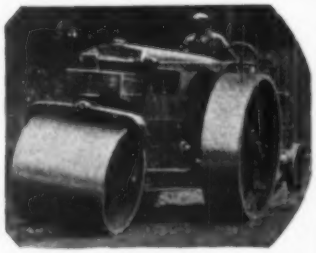
BERG
CONCRETE
HIGHWAY SURFACER

No other tool or method like it. Unquestionably the greatest time, money and labor saver ever developed.
Quickly produces a surface as even as a billiard table. Easily operated by only one man. No previous experience or instruction required. Does the work of ten men. Low operating cost (only $1 a day for gas and oils).
Used and endorsed by State Highway Commissions, Municipalities, leading engineers and contractors.
Complete and interesting details mailed on request. Write

THE CONCRETE SURFACING MACHINERY CO.
Pioneer Makers of Machines for all kinds of Concrete Surfacing
Winton Place, Cincinnati, Ohio

Reputation

Buffalo-Springfield Rollers



BUFFALO-SPRINGFIELD ROLLERS are in more general use than any other make—best evidence that the men who build our roads and streets prefer them.

Motor and steam three-wheel rollers
Motor and steam Tandem rollers
General Duty Maintenance rollers

All practical sizes. Scarifier and other attachments optional.

Illustrated literature ready to mail

The Buffalo-Springfield Roller Co.
Springfield, Ohio

Buffalo-Springfield ROLLERS

HUG
ROADBUILDER TRUCKS

"Earning Capacity"

The earning capacity of any equipment depends upon its ability to meet specific operating conditions.

The superior earning capacity of the Hug Roadbuilder is due to specialized design that meets Roadbuilding conditions. Every feature of Hug design is the result of experience gained in the Roadbuilding field. These exclusive Hug features are essential for successful roadbuilding performance and increased earning capacity.

Write for descriptive literature.
Visit the Hug Exhibit at the Cleveland Road Show
THE HUG CO., Highland, Ill.

Do you mention ROADS AND STREETS when writing? Please do.

IRON MULE

TRADE MARK REG. U.S. PAT. OFF.

The Original 2 Yard Tractor Dump

90 DAYS or . . . . . !

WELL you know what a broken contract means. And—so did L. G. Carey, a Cleveland contractor, who contracted to move 110,000 yards of dirt in 90 days.

90 days, mind you, with 3-up teams that took 12 minutes to haul ONE yard 800 feet. It certainly looked as if he was up against it until the Hughes-Keenan "Iron Mule" demonstrated its ability to haul 9 yards of earth to a 3-teamed wagon's one.

Carey bought 12 "Iron Mules" and had that 110,000 yard dirt moving contract licked on time beside saving thousands of dollars in animal and wagon investment.

When an "Iron Mule" can haul 9 yards of dirt to a 3-teamed wagon's one, when hundreds of contractors buy and keep on buying "Iron Mules", and when 60% of our present business is filling repeat orders, "Iron Mules" *must* be worth your consideration for short haul dirt moving.

See them in action. We'll tell you where.

The Hughes-Keenan Company, Mansfield, Ohio

See Hughes-Keenan "Iron Mules" at 1929 Road Show. Space WW75. West Wing of Auditorium, Cleveland, O.

HUGHES-KEENAN

Steel Dump Bodies

Jaeger Heavy Duty 10 S Holds 2 Bags

Built of Steel - ½ ton lighter, 50% stronger

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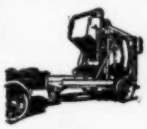

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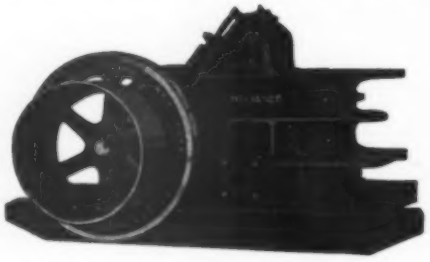

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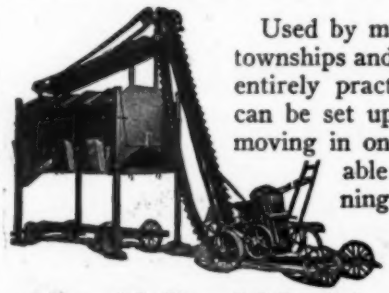

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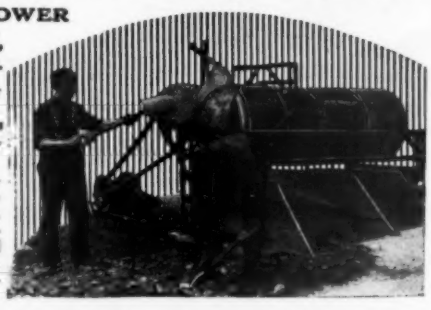

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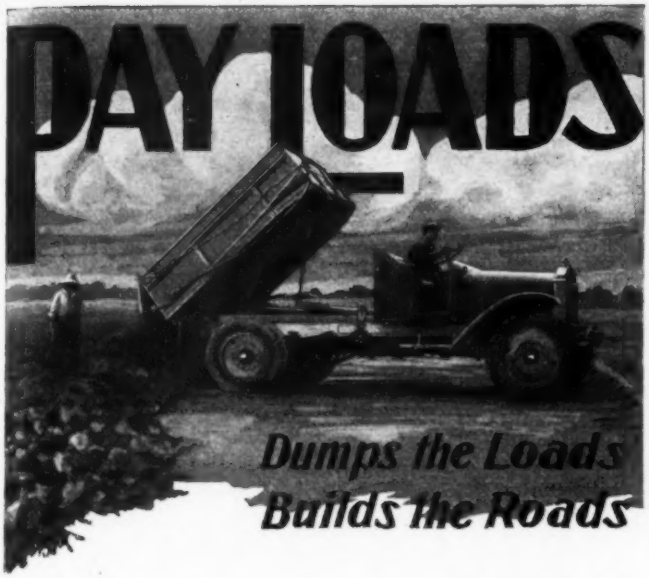

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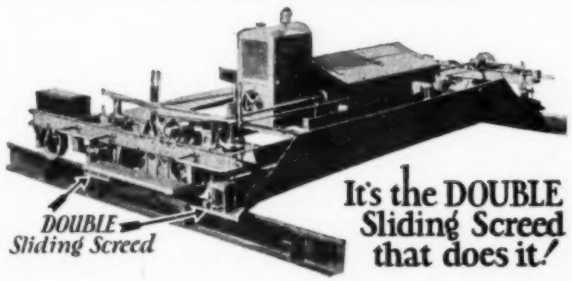

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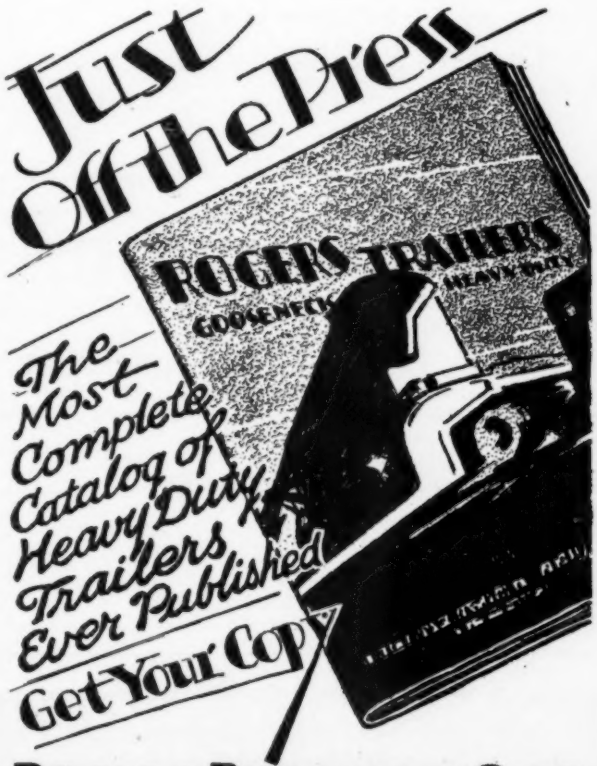

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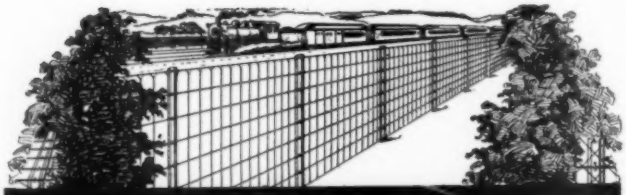

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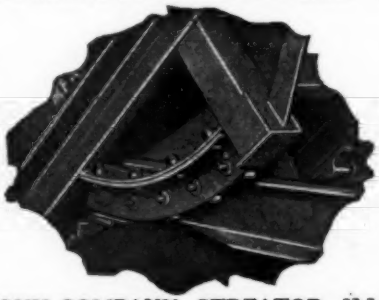

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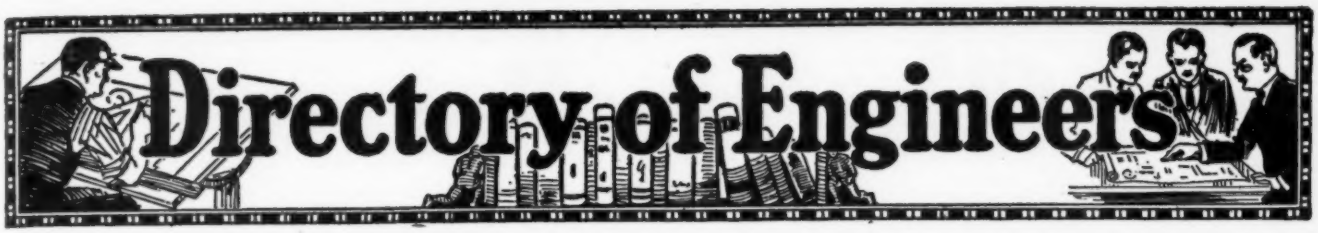

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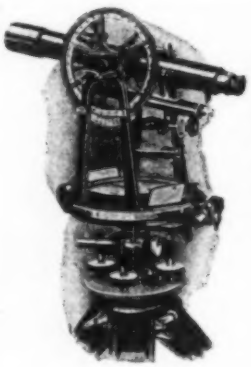

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3556 Road Strip, Metal
3560 Rock Drill Accessories (Drill Steel, Hose, Valve Couplings, Air Valves, Etc.)
3565 Rockers, Bridge
3570 Rods, Turnbuckle
3572 Rods, Leveling
3575 Rods, Wire
3580 Rollers, Road
3610 Rolls, Recrushing
3615 Roofing (Galvanized Armco Ingot Iron)
3620 Roofing, Pitch
3625 Roof Trimmings, Metal
3630 Rooters
3635 Rope, Manila
3640 Rope, Wire
3645 Rope, Wire, Lubricants
3655 Rules, Calipers, Tapes, Etc.
3660 Sack Balers
3665 Sack Cleaning Machines
3670 Salamanders
3675 Sand and Gravel Handling Machinery
3680 Sand and Gravel Plants
3685 Sand Blast Equipment
3690 Sash, Steel
3695 Saw Rigs
3700 Saws, Rail
3705 Scales, Motor Truck
3710 Scarifier Teeth
3715 Scarifiers
3720 Scarifiers, Road
3725 Scarifiers, Grader
3730 Scoops and Spades
3731 Scrapers, Automatic
3735 Scrapers, Drag
3740 Scrapers, Drag, Power
3745 Scrapers, Fordson Power
3750 Scrapers, Fresno
3755 Scrapers, Four-Wheel Self-Loading
3760 Scrapers, Mormon
3765 Scrapers, Slip
3770 Scrapers, Tractor
3775 Scrapers, Wheeled
3780 Screening Plants, Sand and Gravel
3785 Screens, Gravel Washing
3790 Screens, Intake
3795 Screens, Revolving
3800 Screens, Sand and Gravel
3805 Screens, Sewage
3810 Screens, Stone
3815 Screens, Well
3820 Segment Blocks, Vitrified Salt Glazed Clay
3825 Tanks, Septic
3830 Service Boxes
3835 Sewage Disposal Plants
3840 Screens, Sewage (Band)
3845 Sewage Treatment
3850 Sewage Ejectors
3855 Sewer, Braces
3857 Sewer Cleaning Machines
3859 Sewer Joint Compounds
3860 Shanking Machines, Drill Steel
3865 Sharpeners, Rock Drill, Steel
3870 Sheathing and Sound Deadening
3875 Sheathing Paper
3880 Sheaves
3885 Sheet Metal Products
3890 Sheet Metal Work
3895 Sheets, Iron
3900 Sheet, Iron, Black & Blue Annealed
3908 Shores
3910 Shovel (Power) Parts
3920 Shovels, Asphalt
3940 Shovels, Gasoline
3950 Shovels, Hand Contractors'
3980 Siding
3985 Sign Posts, Crossing
3990 Signs, Highway
3995 Signs, Street
4000 Siphons
4005 Skips, Cableway
4010 Skylights
4015 Sleeves, Tapping
4020 Sluice Gates
4025 Smoke Stacks
4030 Smoothers, Asphalt
4035 Snow Removal Machinery
4045 Soldering Irons
4050 Spacers, Bridge, Highway
4055 Spacers, Culvert, Concrete
4060 Spaders, Clay
4065 Spacers, Slab, Concrete
4067 Speed Reducers
4070 Spikes, Railroad
4075 Spreaders, Sand
4080 Spreaders, Stone & Gravel
4085 Sprinklers, Road & Street
4090 Sprockets, Sheaves
4100 Squibs, Electric
4105 Stakes (Concrete)
4110 Stair Treads
4115 Stairs, Steel
4123 Starters, Motor
4125 Steel, Angles, Bars, Channels, Shapes, Plates, Sheets
4130 Steel, Structural
4135 Steel Domes for Reinforced Concrete Floors
4145 Stokers, Mechanical
4165 Stone Skips
4170 Strainers, Well
4175 Street Light Standards
4180 Strip, Road
4185 Strips, Pins and Accessories for Concrete Road Reinforcing
4190 Stump Pullers
4195 Subgrading Machines
4196 Supplies, Drafting & Surveying
4200 Surety Bonds
4203 Surfacers, Floor
4205 Surfacer, Road
4210 Surveying Instruments
4215 Sweepers, Street (Motor and Horse Drawn)
4220 Switches, Portable
4225 Tablets, Bronze
4230 Tables, Transfer
4235 Tampers, Asphalt
4240 Tampers, Backfill
4247 Tampers, Trench
4250 Tank Level Controller
4255 Tanks
4260 Tanks and Towers, Water
4265 Tanks, Oil Storage
4270 Tanks, Sand Settling
4275 Tanks, Sprinkling
4280 Tanks, Steel (Fuel and Water)
4285 Tapes, Metallic
4290 Tapping Machines, Water and Gas Mains
4295 Tapping Machine Sleeves and Valves
4300 Tar, Road
4305 Tar and Pitch, Paving
4310 Teeth, Dipper and Bucket (Manganese Steel)
4312 Teeth, Scarifier
4315 Templates, Subgrade
4320 Templets, Stripe-Off
4325 Templets, Wood, Paving Gauge
4328 Templates
4332 Tents, Awnings and Tarpaulins
4335 Testing Machines, Cement
4340 Testing Machines, Cement and Road Materials
4345 Tests, Road Material
4350 Ties, Steel
4355 Tile, Building
4360 Tile, Cement
4365 Tile, Drain
4370 Tile, Rubber
4372 Timber
4374 Tires
4380 Tools, Asphalt Paving
4385 Tools, Caulking
4390 Tools, Draining and Ditching
4395 Tools, Hand, Blacksmith
4400 Tools, Hydraulic
4405 Tools, Mechanics
4410 Tools, Pipe Jointing
4415 Tools, Pneumatic
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4425 Torches, Kerosene
4430 Torches, Thawing, Oil & Kerosene
4433 Towers & Chuting Equipment
4435 Track, Industrial & Portable
4440 Track Pull
4450 Tracks, Rail
4460 Tractors
4470 Tractors, Caterpillar, Crawler Traction
4475 Tractors, Industrial
4490 Tractors, Wheel
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4505 Treads, Traffic
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4525 Trailers, Logging and Pole
4530 Trailers, Motor Truck
4540 Tramways (Aerial Wire Rope)
4545 Transits & Levels
4547 Transmission
4550 Trench Machines
4555 Trench Machine Parts (Manganese Steel)
4560 Trolleys, I-Beam
4563 Truck Tractor
4573 Trucks, Road, Batch Box
4575 Trucks, Dump
4580 Trucks, Machinery
4585 Trucks, Motor
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4597 Truck Tires
4605 Trusses, Standard (Steel)
4607 Tubs, Filter
4610 Turbine Gears
4615 Turbine (Hydraulic and Steam)
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4625 Turnouts
4630 Turntables, Industrial Railway
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4650 Unloaders, Coal, Stone
4655 Unloaders, Conveyor
4660 Unloading Plants
4665 Used Equipment
4670 Valve Boxes
4675 Valve Control, Electric (Mechanical)
4680 Valve Indicators
4685 Valves, Altitude and Regulating
4690 Valves, Air and Vacuum
4695 Valves, Angle, Check, Gate, Glove, Etc.
4700 Valves, Automatic Air
4705 Valves, Fire Service
4710 Valves, Float
4715 Valves, Flush
4720 Valves, Foot
4725 Valves
4730 Valves, Gate
4732 Valves, Pipe
4733 Valves, Water Relief
4735 Ventilators
4740 Ventilators, Shop, Roundhouse
4745 Wagons, Asphalt
4750 Wagons, Dump
4755 Wagons, Dump, Horse Drawn
4760 Wagons, Sprinkling
4765 Wagons, Stone Spreader
4770 Wainscoting & Capping
4775 Wall Coping (Vitrified Salt Glazed Clay)
4780 Washers
4785 Washing Plants, Sand & Gravel
4795 Water Filters
4805 Water Leak Locating Instruments
4810 Water Level Recorders
4815 Water Main Cleaning
4820 Waterproofing, Oil, Asphalt
4825 Waterproofing (Compounds and Material)
4830 Water Purification (Control)
4831 Water Softening Equipment
4840 Water Sterilization (Violet Ray)
4850 Water Works Supplies
4855 Weed Killer
4860 Welders, Electric
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4885 Well Equipment (Artesian Cylinders)
4890 Well Heads
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4905 Wheelbarrows
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4933 Wheels, Tractor
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4955 Windows (Steel, Hollow Windows, Wire glass, Fireproof)
4960 Wire and Cable
4965 Wire Brushes (Pneumatic)
4970 Wire, Leading and Connecting
4975 Wire Rope and Fittings
4980 Wire, Steel
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485 Cable Retainer, Bolts and Plates
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525 Caps, Pile
530 Capstans Windlasses and Winches
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540 Car Spreaders
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560 Cars, Industrial V Dump
565 Cars, Motor, Railway
570 Cars, Quarry
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1100 Curb Boxes
1105 Curb
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1250 Drilling Machines, Gas Main
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1260 Drills, Air Hammer
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1283 Drills, Earth, Fence Post
1287 Drills, Hammer (Hand Rotated)
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1295 Drills, Prospecting (Core)
1300 Drills, Railway Track
1305 Drills, Rock (Penumatic)
1310 Drills, Testing Hydraulic
1320 Drill Steel Furnaces
1325 Drill Steel, Rock (When in doubt use this list)
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1940 Hammers, Chipping
1945 Hammers, Pile Driver
1950 Hammers, Pneumatic
1955 Hammers, Riveting
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1965 Handsaws
1970 Headgates
1975 Headwalls
1980 Heaters & Dryers, Sand and Gravel
1990 Heaters & Patchers, Asphalt Surface
1995 Heaters, Asphalt Tool
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2020 Heaters, Water
2025 Hemp, Braided
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2075 Hoists, Hand
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2100 Hoists, Scraper Loader
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2110 Holders-On, Riveting
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2500 Maintainers, Road
2505 Manganese Steel Parts
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2600 Mixers, Grout
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2620 Motors, Air
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2645 Mountings, Truck Rubber Tires
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2805 Paving Guards, Steel
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2815 Pens, Lettering
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2826 Pile Drivers (Combination Locomotive Crane)
2830 Pile Hammers, Steam
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2840 Piles, Screw
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2890 Pipe, Dredge & Pontoon
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2927 Pipe, Water
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2980 Pipe Cleaning
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3140 Plows, Unloading
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3160 Post and Hole Machinery
3170 Posts, Fence
3175 Posts, Mile & Whistle
3180 Pots and Kettles, Metal Melting
3185 Poultry Netting
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3205 Power Heads
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3230 Pulleys, Clutch
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3260 Pumps, Air
3265 Pumps, Air Lift
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3380 Pumps, Roadbuilders'
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3390 Pumps, Sinking
3395 Pumps, Steam
3400 Pumps, Sump
3405 Pumps, Trench, Portable
3410 Pumps, Triplex
3415 Pumps, Turbine
3420 Pumps, Vacuum
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3430 Pumps, Wrecking
3435 Punches, Shank and Bit
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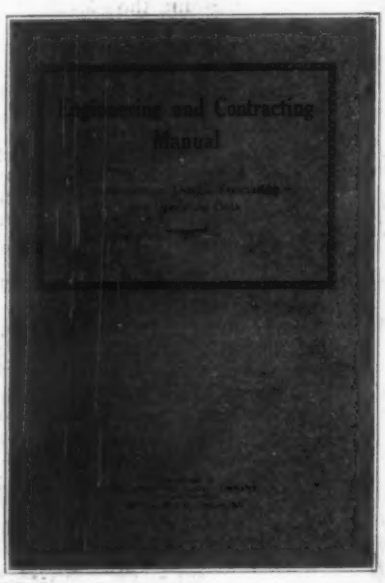

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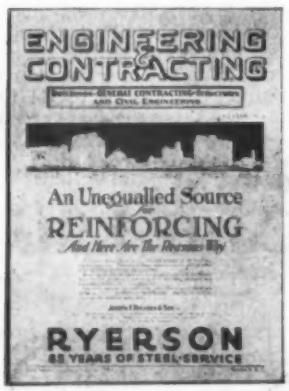

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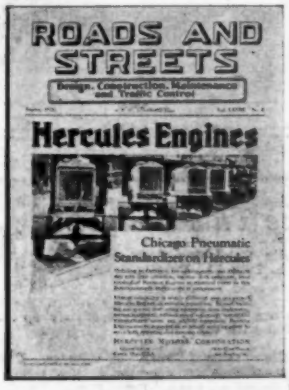

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